EXHIBIT 62

FACILITIES PLANNING REPORT FOR SEWER OVERFLOW ABATEMENT

TEXT

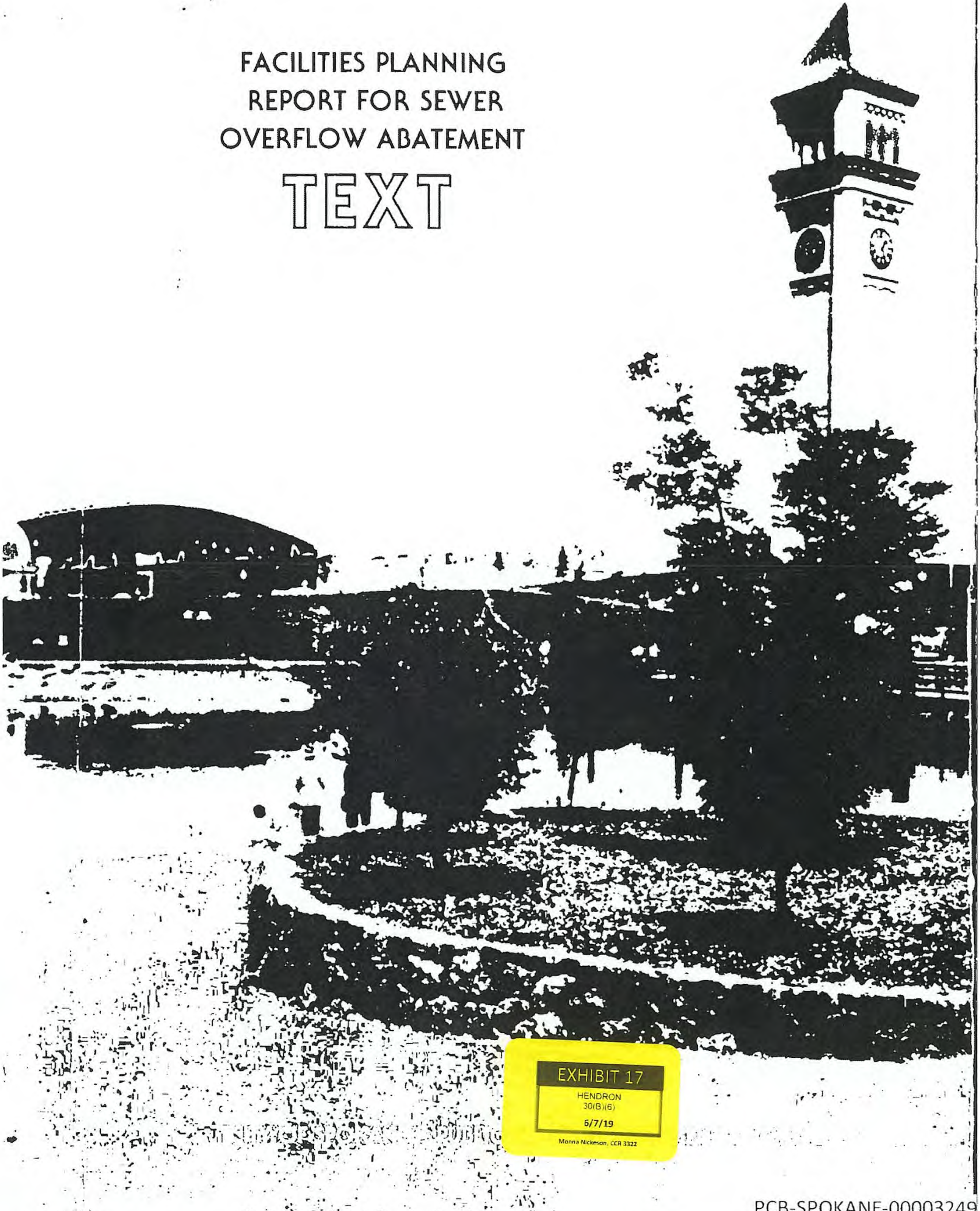


EXHIBIT 17
HENDRON
30(B)(6)
6/7/19
Monna Nickeson, CCR 3322

FACILITIES PLANNING REPORT
FOR
SEWER OVERFLOW ABATEMENT

TEXT

CITY OF SPOKANE
PUBLIC WORKS DEPARTMENT
1977

FOREWORD

The Spokane River is one of the greatest natural resources possessed by the City of Spokane. Every effort should be made to protect and preserve this resource from environmental degradation. This Facilities Plan is a part of that effort. The Facilities Plan proposes an abatement of storm-sanitary overflow to the Spokane River. The major effects of this overflow abatement on the Spokane River are:

- Decrease of unnecessary exposure of the general community to water borne pathogenic diseases.
- Decrease the occurrence of dysentery, diarrhea and other stomach ailments to State Park visitors.
- Decrease high fecal coliform counts in the river after each rain storm.
- Decrease the State Parks maintenance in cleaning the shoreline of the river.
- Decrease the rate of organic sedimentation.
- Increase public opinion of water quality.
- Increase the public usage of the water for recreational purposes.
- Increase the economic value of shoreline property.
- Increase the aesthetic appearance of the shoreline and bottom sediments of the river.

The users of the lower Spokane River will be the primary beneficiaries of storm-sanitary overflow abatement from combined sewers. The downstream benefits gained by each user

are dependent on individual requirements and the impact that abatement has on each particular need.

The lower Spokane River generally begins at Spokane Falls located in the center of the City of Spokane, approximately 74 miles upstream from the mouth of the river. The river is free flowing for 10 miles immediately below the falls. The remainder of the river is backwater for four hydro-electric dams; Nine Mile, Long Lake, Little Falls, and Grand Coulee in that order.

Ownership and management of the lands adjacent to the Spokane River are varied. The Washington State Park system owns large areas of land adjacent to the river immediately north and west of Spokane. The Spokane Indian Tribe owns a large area of land near the confluence of the Spokane River with the Columbia River. The National Park Service manages land as a National Recreational Area in this same area. The City of Spokane Park Department owns and utilizes a portion of the land adjacent to the river within the City limits. Individuals and corporations own and manage the remainder of the shorelines.

All owners utilize the river and its shorelines for a variety of different purposes.

The principal uses of the river are for recreation and hydroelectric power. The secondary uses of the river are for irrigation and commercial purposes. The hydroelectric and recreational uses are interdependent. The pools created by the dams provide the quiet stretches of water needed for certain types of recreation.

The river shorelines are partially developed and provide exceptionally scenic views such as at the Bowl and Pitcher Area in Riverside State Park. Riverside State Park is located on approximately one-third of the shoreline and receives over 1,000,000 visitors each year. The park offers histroical sites, camping, picnicking and hiking facilities and attracts many non-resident visitors, 50,000 per year coming from Canada. Many park visitors participate in non-supervised activities; wading, swimming, scuba diving and fishing. State Park personnel have future plans to install swimming facilities at the Park. The clean-up of the river would have a decided effect on long range park plans. An increased use of the river will occur if the river is cleaned up.

The free flowing stretch of the river has certain features that make it an important recreational area and economic attraction for the Spokane community. The Washington Environmental Atlas lists the river immediately downstream from Spokane as a white water area and a critical wildlife habitat. The white water stretches provide local kayak and canoe clubs an excellent practice area for improving boating skills. This section of the river contains many deep pools and riffle areas which are ideal for the only self-sustaining brown trout population in Spokane County.

The Spokane Indians use or plan to use the water from the Spokane River in a variety of ways. The Indians draw water for irrigation and livestock watering. They have plans to

expand the irrigation system. The currant water quality of the river does have an effect on tribal planned uses of the river and its waters. They are looking forward to future clean-up of the Spokane River for expanding recreational and economic development for the tribe.

The river downstream from Little Falls Dam is a backwater of Lake Roosevelt created by Grand Coulee Dam. This area is classified as a National Recreational Area and the south shoreline is administered by the National Park Service. The north shoreline from and including Little Falls reservoir to the Columbia River is owned and administered by the Spokane Indian Tribe. This section of river has become popular for walleyed pike fishing each summer. The shoreline in this area and along Little Falls reservoir is a known sanctuary and feeding area for bald eagles.

Eastern Washington State College utilizes the Spokane River in the Bowl and Pitcher area for its outdoor and rafting classes. This is a fast expanding program with other area colleges becoming involved in utilizing the river. Periods of combined storm and sanitary discharge would not be an appropriate time for these activities.

Secondary uses of the river include irrigation, mineral processing water for Western Nuclear, and cooling water for a proposed power generating plant. Approximately 100 wells are located near the river and do fluctuate with the river level. The largest wells are operated by Fairchild Air Force Base. No

known water is presently being withdrawn from the lower Spokane River for human consumption. It is possible that a few people on a periodic basis use the river for domestic purposes.

The Nine Mile reservoir is the first impoundment located below the City of Spokane. The reservoir was built in 1908, contains 440 acres, and currently provides little recreational use to the community.

Long Lake reservoir is the largest and most important hunting and fishing area on the lower Spokane River. The reservoir was built in 1915 and occupies 5060 acres. Four resorts are located on the lake. Approximately 8,000 fishermen visit the lake each year. Long Lake is considered the best large mouth bass area in Washington. The lake is also an important resting area for water fowl. An estimated 13,000 to 14,000 ducks and geese are harvested each fall. Some residential developments have been started along the lake. These residents do some swimming, scuba diving and water skiing. In late summer, the lake develops an eutrophication problem. A few domestic animals were reported to have died, possibly from a toxin produced by an algae bloom in the lake.

Many local residents are aware of water quality problems along the lower Spokane River because of the combined sewer storm overflows. These people will not use the river for recreational purposes. Shoreline real estate developments have not sold as well as those upstream from Spokane. Land values are less than other locations around the City. Home ownership along the lower Spokane River would increase if the river were cleaner.

Bacteriological quality of the lower Spokane River is the greatest concern of the users and agencies. The Spokane River has been sampled since 1967. The data shows that the total and fecal coliform counts rise with each significant rain storm because of combined sewer overflows. The degree of rise is largely dependent upon duration, intensity, season and time of day for the storm period. After many of the rain storms, the coliform counts of river water have risen above the nationally accepted water quality standards for drinking water, swimming, and other human contact activities. The effects of high coliform counts have extended into the upper reaches of Long Lake and are known to persist for up to two weeks. In addition to the bacteriological contamination, combined sewer overflows add nutrients to the river thus contributing to Long Lake's eutrophication. A restoration of Long Lake can be expected to occur with the upgrading of the sewage treatment plant and elimination of combined sewer overflows.

The overflow of sanitary sewage into the river creates a significant potential for the transmission of diseases. The health districts have not confirmed that any disease or illness was caused by the river water. The health agencies report that a number of picnickers along the river each year develop stomach aches or dysentery. Stevens County Health District offices report higher incidences of infectious hepatitis and staph infections among people living along the river. Several wells along the river have been found to contain bad water, although no investigations

were made to determine if the water quality of each well was influenced by the river. A well at Riverside State Park was abandoned because of health concerns.

A number of water borne diseases and parasites may be hosted by pets, livestock, wildlife and fish. These include typhoid, shigella, infectious hepatitis, echinococcus, cystic ercosis, round worms and tape worms. The State Game Department personnel have no personal knowledge of any animal-human illnesses caused by water quality in the Spokane River. The Animal Health Division was particularly concerned about the spread of tape worms. The presence of sanitary wastes from storm overflows does provide an unnecessary exposure and potentially threatens the health of both animals and humans along the river.

The elimination of storm caused sanitary overflows would improve the aesthetic qualities of the river. The combined overflows introduce into the waterway unsightly toilet related debris, nutrients and organic solids. This debris and the water quality are major causes of river related inquiries to the area health districts. The State Parks personnel spend considerable manpower in cleaning the river shoreline. The sanitary sewage contributes to the growth of algae and plants in the reservoirs. The organic materials darken the river bottom sediments, making the waterway less desirable for swimming, wading and other activities.

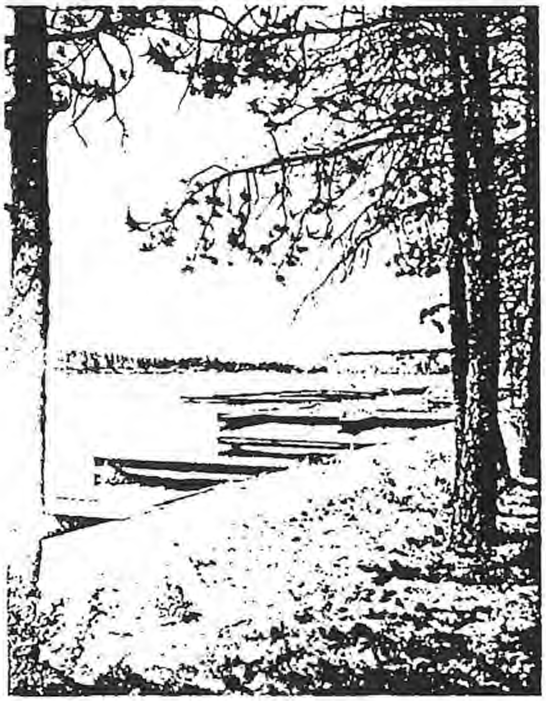
The general position of environmental groups in the Spokane area is

"that such a jewel as the Spokane River which

travels through the metropolitan area should be used by the people for picnicking, recreational activities, and should not be abused. Failure to end the combined sanitary discharges would mean continued deterioration of the water quality of Long Lake and substantial increases in the cost of reclamation and the time needed to restore water quality."

Finally, the general public's opinion of increasing the water quality of the river and reservoirs is that it would improve the economic and recreational value of the river and the shoreline properties.

This FOREWORD was composed from consultation with numerous private and governmental organizations concerned with the Spokane River. From these interviews and other sources the more pertinent information was consolidated and utilized. A summary of the information obtained in these interviews is included as Appendix 17.



Private park and docks at Suncrest development on Long Lake

Footbridge at Bowl & Pitcher, Riverside State Park

Swimmers at Willow Bay on Long Lake near Tum Tum, Washington

FACILITIES PLANNING REPORT FOR

SEWER OVERFLOW ABATEMENT

CITY OF SPOKANE

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FACILITIES PLANNING REPORT FOR SEWER OVERFLOW ABATEMENT CITY OF SPOKANE

INTRODUCTION

STUDY PURPOSE AND SCOPE

The purpose of this facilities planning report is to arrive at a cost effective solution for eliminating combined storm and sanitary sewage overflows to the Spokane River. To accomplish this objective a priority list has been developed arranging each overflow point in accordance with severity of overflows to the Spokane River. City wide solutions to the overflow problem will be described in this report and implementation of these solutions will be addressed in accordance with the priority list.

PLANNING AREA AND DESCRIPTION

The project area consists of the entire area within the City limits of Spokane served by the City's sewer system. This system was first started in the 1890's in the Central Business District Area of the City and was expanded outward as the City grew. Most of the sewers were constructed as combined storm and sanitary sewers with discharge directly to the Spokane River. In 1958, the City's existing sewage treatment plant (presently being expanded) and interceptor sewer system were completed. The interceptor sewers were constructed parallel to the river to pick up dry weather sanitary sewage flows and transport this sewage to the treatment plant.

During wet weather conditions, the interceptor sewer system has only limited storm runoff capacity. Consequently, combined storm and sanitary sewage overflows occur to the Spokane River at 33 different overflow points during storm runoff periods. In addition, three of the above overflow points, which are located at Erie Street, Front Avenue, and Mallon Avenue, respectively, have periodic dry weather discharges of sanitary sewage to the river. These discharges occur when river levels are high due to spring runoff. Both the interceptor sewer and the overflow pipes at the above three locations are below the annual high water mark of the river, and during high river levels gates are closed to prevent river water from entering the interceptor sewer system. This situation causes dry weather sewage flows to enter the river from one to four months yearly.

In addition to the above mentioned 33 overflow points, there are nine other overflow points within the City that should be mentioned. These overflow points really should be referred to as by-passes or blowoffs. One is the by-pass at the City's Sewage Treatment Plant, five are by-passes at pump stations, and three are blowoffs at syphons. The by-pass at the Sewage Treatment Plant will soon be eliminated upon completion of the City's new treatment plant. The treatment plant is being expanded so that all combined storm and sanitary flow reaching the plant will, as a minimum, receive primary treatment. The by-passes at the pump stations and blowoffs at the syphons do not involve storm runoff, and will discharge sanitary sewage to the river only if the system fails. With proper maintenance

these systems should function without overflows. Therefore, the remainder of this report will consider only the 33 wet weather overflow points. (Includes the three overflow points that also experience dry weather overflow problems)

Additional information concerning the sewer system and other features of the City of Spokane can be found in a waste water action plan report prepared for the City in 1972.[1] Exhibit 1 is a map of the City of Spokane showing the planning area involved.

[1]Esvelt and Saxon/Bovay Engineers, Inc., Consulting Engineers, Spokane Waste Water Study, July 1972.

WATER QUALITY OBJECTIVES AND OTHER WATER MANAGEMENT GOALS

WATER QUALITY OBJECTIVES

The primary objective of this study is to find ways to eliminate sanitary sewage discharges to the Spokane River. The Spokane River originates in Idaho's Lake Coeur d'Alene about 30 miles to the east of the City and flows westerly to empty into the Columbia River about 70 miles west of Spokane. The river is over 100 miles long with about 10 miles of its length within the City limits of Spokane. Flow in the river can vary from a maximum approaching 50,000 cfs to low flow values around 1,000 cfs. The Spokane River has been assigned a "Class A" standard by the State of Washington, and this report will address this standard. (See "Spokane and Vicinity Map" - Exhibit 2)

OTHER WATER MANAGEMENT GOALS

In trying to satisfy the objective of eliminating the sanitary sewer discharges to the Spokane River during storm overflow periods, it becomes apparent that there are other related problems. A proper cost-effective analysis should consider all problems during the facilities planning stage since analysis could reveal that certain solutions to the major problem will also solve other problems with little or no additional costs. Therefore, in addition to the primary objective, another management goal is to eliminate or greatly reduce sewer overloading conditions which have caused sewer backups into basements and other related drainage problems within the City. Sewage backups have, over the years, caused personal property damage and create health and safety hazards during each occurrence.

SUMMARY OF GOALS AND OBJECTIVES

The overall goal of this study is to provide the best drainage management system for the City of Spokane which will minimize total costs to society over time to reliably meet the above goals and objectives.[2]

[2]United States Environmental Protection Agency, Guidance For Facilities Planning, January 1974, p. 6.

SUMMARY OF POLLUTION SOURCES, WASTE LOADS, AND WATER QUALITY

POLLUTION SOURCES

As described in earlier sections of this report, the pollution sources being addressed in this study are the combined storm and sanitary sewer overflow pipes through which untreated sanitary sewage may be discharged to the Spokane River. Of the 33 overflow points of this type within the City, 31 discharge to the Spokane River and 2 discharge to Hangman (Latah) Creek, which is a tributary to the Spokane River. The overflow points to the Spokane River identified as 032, 034, and 035 are the ones that, in addition to wet weather overflows, experience dry weather discharges of sanitary sewage to the river when river levels are high due to spring runoff. Table 1 lists each overflow point and Exhibit 3 is a map showing the location of each overflow point.

TABLE 1

OVERFLOW POINTS LIST

	DISCHARGE NUMBER	LOCATION - TYPE	AVERAGE DISCHARGE* FREQUENCY	DURATION	VOLUME
1	002	Hartley Street - Overflow	17	1.57	20.
2	003	Hollywood - Overflow	47	9.4	1,250.
	~~004~~	~~Sewage Treatment Plant~~ - By-pass	60	3.75	9,300.
3	006	Garland Ave. - Overflow	23	1.8	170.
4	007	Columbia Circle - Overflow	69	2.12	40.
	008	Rivercrest Pump Station By-pass	---	---	---
	009	Ft. George Wright Syphon-Blowoff	---	---	---
5	010	T. J. Meenach Drive - Overflow	66	9.21	6,100.
	011	Ft. George Wright-Pump St.-By-pass	---	---	---
6	012	Nora and Pettet Drive - Overflow	69	2.12	120.
	013	Natatorium Park-Pump St. - By-pass	---	---	---
7	014	Sherwood & Summit - Overflow	20	1.74	20.
8	015	Ohio Avenue - Overflow	46	9.32	150.
9	016	High Bridge Park - Overflow	17	1.70	100.
10	017	Westgrove Sewer Syphon - Overflow	2	8.0	10.
	018	Federal Sewer Syphon - Blowoff	---	---	---
11	019	Seventh Ave. & Canyon Hill - Overflow	4	.87	10.
12	020	So. Manito Relief Sewer - Overflow	4	.61	70.
13	021	Clark Avenue - By-pass	---	---	---
	022(A)	Elm Street - By-pass	---	---	---
14	022(B)	Elm Street - Overflow	2	8.0	10.
15	023	Cedar & Ide Street - Overflow	37	1.95	80.
16	024	Cedar & Riverside - Overflow	23	1.8	390.
17	025	Cedar & Main Avenue - Overflow	22	1.80	10.
18	026	Lincoln & Trent Ave. - Overflow	37	2.02	420.
19	027	Monroe Street - Overflow	20	1.72	80.
	028	Division "D" Inter.Syphon - Blowoff	---	---	---
20	029	Howard Street - Overflow	37	1.95	80.
21	030	Washington Street - Overflow	23	1.72	240.
~~22~~	~~031~~	~~Astor at Desmet - Overflow~~	10	1.08	10.
	032(A)	Erie Street - Overflow	3	.63	30.
	032(B)	Erie Street - Overflow	0	0.0	0.0
22	033	Erie Street - Overflow	27	1.98	460.
	034	Front Avenue - Overflow	20	1.72	550.
	035	~~Mallon Avenue~~ - Overflow	59	3.15	90.
	036	Desmet Avenue - Overflow	1	1.0	5.
	~~037~~	~~Sharp Avenue - Overflow~~	47	9.5	280.
23	038	Magnolia Street - Overflow	17	1.56	20.
24	039	Altamont Street - Overflow	5	.83	10.
25	040	Regal Street - Overflow	75	2.73	20.
26	041	Rebecca Street - Overflow	17	1.56	30.
27	042	Surro Drive - Overflow	3	.35	10.

NOTE: (1) Numbers 002-004, 006-018 and 021-042 discharge to the Spokane River.

(2) Numbers 019&020 Discharge to Hangman (Latah) Creek.

*Frequency in times per year; Duration in hours per event; Volume in thousands of gallons per event.

WASTE LOADS

Population densities for most of the City are fairly uniform ranging from approximately 7 to 10 people per acre. This would indicate that combined sewer overflows contain about the same concentration of sanitary sewage City-wide. Concentrations of sanitary sewage will vary in combined overflows depending on the amount of storm flow generated by each storm event. Samples taken after the first flush in combined sewers during storm runoff have shown BOD to range from about 20 to 210 mg/1, suspended solids from 76 to 220 mg/1, volatile suspended solids from 14 to 35 mg/1, phosphorous from .95 to 1.9 mg/1, and kjeldahl nitrogen from 5 to 12 mg/1.[3] Two samples taken in Meenach Drive overflow (010) on November 11, 1974, gave coliform counts of more than 2,400,000/100 ml for both fecal and total coliform for the one sample and 460,000/100 ml (fecal) and more than 2,400,000/100 ml (total) for the other.

SUMMARY OF RECEIVING WATER QUALITY

General

Various individuals and agencies have, over the years, conducted water quality studies of the Spokane River, and the City of Spokane has, as part of this facilities planning study, been involved in a limited sampling program. This section will utilize the results of these studies to summarize the water quality of the Spokane River during dry and wet weather flow.

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[3] Esvelt and Saxon/Bovay Engineers Inc., Consulting Engineers, Spokane Waste Water Study, July 1972, pp. 2 and 16.

The Spokane River is designated as a "Class A" river, and the parameters listed for "Class A" standards will be discussed in this section. The river is considered to be usable for all the characteristic uses listed for "Class A" rivers and can possess all the necessary aesthetic values desired by the standard. The water quality criteria of the "Class A" standards will be discussed in the following paragraphs.

Dissolved Oxygen

For "Class A" rivers the dissolved oxygen level shall exceed 8.0 mg/l. Previous studies indicate that the Spokane River is meeting or exceeding this standard within the City limits. There have been lower than 8.0 mg/l readings taken within the City in the past, but most can be explained by pollution sources to the river which have since been eliminated. Studies in 1971 by the Washington State Department of Ecology showed the average dissolved oxygen content of the river within the City limits to be about 8 to 9 mg/l during the summer and 11 to 12 mg/l in the winter.[4] More recent information published by the United States Geological Survey (USGS) confirms the above dissolved oxygen values.

The Spokane River has experienced low dissolved oxygen values below the sewage treatment plant with values dropping below standard during the summer months in the reser-

[4]Esvelt and Saxon/Bovay Engineers, Inc., Consulting Engineers, Spokane Waste Water Study, July 1972, p. 7.

voirs behind Nine Mile and Long Lake Dams. The effluent from the City's old primary sewage treatment plant and the presence of the dams themselves are thought to be the primary causes of this problem. Whether this situation will improve now that the City's new treatment plant is completed remains to be seen. The BOD loadings (and phosphorus loading as related to algae growth and related dissolved oxygen problems) to the river from the 33 combined sewer overflow points are not thought to have a significant impact on the dissolved oxygen level in the river. However, any reduction in these loadings would be another step forward in removing pollutants from the river which can contribute to dissolved oxygen problems.

Total Dissolved Gas

Little information is available concerning total dissolved gas in the Spokane River. However, some preliminary work done by the Corps of Engineers suggests that dissolved gas supersaturation is a problem during high flows and exceeds the "Class A" standard of 110 percent. The rapid flow over Spokane Falls and the spillways of the dams along the river is the probable cause of this situation, and the combined sewer overflows are not concontributing to this.

Temperature

USGS publications show the water temperature for the entire length of the Spokane River to vary from as low as 2° C in the winter to approaching 20° C in the summer. "Class A" standards call for water temperatures not to exceed 68° F or 20° C thereby making the river just within standards. Generally the temperature of combined sewer overflows is less than 20° C and would not adversely effect the water temperature of the river.

pH

The pH, as recorded in USGS publications, ranges from just below 7 to 8.5 for all reaches of the Spokane River, which is almost within "Class A" standards of 7 to 8.5. The pH of the combined sewer overflows is in this same range and therefore should not noticeably effect the pH values of the river.

Turbidity

"Class A" standards state that turbidity shall not exceed 5 JTU over natural conditions. It is difficult to tell exactly what natural conditions are, but during periods of natural storm runoff, rivers become more turbid. It is doubtful that the runoff from the combined sewer overflows has a significant impact on the river's natural level of turbidity.

Coliform Organisms

The bacteriological quality of the Spokane River is directly effected by the runoff from the combined storm and sanitary sewer overflows. Monitoring the coliform levels in the river gives a good indication as to the extent of this pollution. "Class A" standards call for total coliform organisms not to exceed a median value of 240/100 ml with less than 20 percent of the samples exceeding 1,000/100 ml when associated with any fecal sources.

Samples taken in the river by the City from 1967 through 1972 indicate median coliform levels as shown in Table 2:

TABLE 2

MEDIAN COLIFORM LEVELS IN SPOKANE RIVER FROM 1967 to 1972

Year	Upriver Dam Power Station (East City Limits)		Fort Wright Bridge (Above Meenach Overflow)		Bowl & Pitcher Bridge (Just Below Treatment Plant)	
	Fecal[1]	Total[2]	Fecal	Total	Fecal	Total
1972	(30)[3] LT 30[4]	(30) LT 30	(30) 400	(31) 1100	(29) 700	(27) 2300
1971	(12) 40	(26) 90	(12) 2300	(26) 4300	(11) 900	(25) 4300
1970		(33) 650		(23) 6300		(35) 6000
1969		(29) 50		(30) 4800		(30) 9000
1968		(40) 110		(40) 1400		(38) 930
1967		(46) 230		(46) 2300		(24) 5100

1. Median Fecal Coliform Count
2. Median Total Coliform Count
3. Number of Samples
4. Coliform Count per 100 ml

More recent information in the USGS records show coliform levels for water year, October 1972 to September 1973, as shown in Table 3.

TABLE 3

COLIFORM LEVELS IN SPOKANE RIVER, OCTOBER 1972 TO SEPTEMBER 1973

Date	TRENT[1] BRIDGE		MISSION[2] BRIDGE		COCHRAN[3] GAGE		FORT WRIGHT[4] BRIDGE		BOWL AND[5] PITCHER	
	Fecal	Total	Fecal	Total	Fecal	Total	Fecal	Total	Fecal	Total
Oct.										
10	40-[6]	1500	40-	1200	40-	1000	40-	700	40-	40-
31	20-	640	20-	320	60	540	20-	460	20-	20-
Nov.										
19	20-	620	20-	500	25	650	20-	450	20-	44
29	20-	1000	20-	200	300	1400	80	500	20-	120
Dec.										
12	20-	250	40-	400	80	1250	50	600	20-	40-
27	20-	500	100+	1750	500+	4000+	500+	4000+	40-	800
Jan.										
18	40-	150	100	800	100	1400	200	4000	100-	1000
Feb.										
06	---	---	32	250	40-	150	---	---	40-	200
22	40-	160	40-	200	40-	100	100-	2500	40-	200-
27	40-	100-	120+	1600+	40-	250	100	4000	100-	400
Mar.										
13	40	800+	40-	600	56	1200	100-	1800	40-	280
20	40-	100	---	---	---	---	80	1000	40-	100-
27	40-	140	40-	200	160	1600	66	500	40-	40
Apr.										
10	40-	40-	40-	100-	40-	120	40-	200-	40-	40-
24	54	650	60	320	20-	120	20-	150	20-	40-
June										
12	50	350	20-	600	80	1000	67	600	20-	200
26	20-	325	20-	150	35	1250	20-	600	20-	250
July										
11	20-	1000	20-	100	35	1000	20-	125	20-	140
24	20-	400	20-	50	20-	360	20-	160	20-	40
Aug.										
07	5	980	1	40	15	440	1	120	21000	---
21	---	2000	---	400+	---	1200	---	320	---	4900
Sept.										
12	20-	1300	20-	800	20-	2700	20-	600	4000+	40000+
25	20-	2000-	20-	1100	60	2400	30	1500	400-	2000-

1. Trent Bridge at Trentwood, Washington, located about 5 miles upstream from east City limits

2. Mission Street Bridge between Overflow Points 037 and 038

3. USGS Cochran Street gaging station located near Maple Street Bridge just downstream from Overflow Point 021

4. Fort Wright Bridge at Meenach Drive just upstream of Overflow Point 010

5. At Riverside State Park downstream from treatment plant

6. + More than - Less than

After reviewing the above and other available information on coliform counts in the Spokane River, it became obvious that more detailed information was needed on coliform counts during dry weather and wet weather flows. Therefore, as part of this facility planning study, the City is conducting a limited sampling program to monitor the coliform levels in the river during dry weather flows and during actual combined sewer overflow periods.

Several sets of samples have been taken to date to obtain dry weather flow coliform counts in the Spokane River. Results of these samples indicate that the river can meet "Class A" standards during dry weather flow. Three of the dry weather flow samples were taken during high river levels when gates at Overflow Points 032, 034, and 035 were closed allowing dry weather sewage discharges to the river from a population area of about 31,000 people. Fecal coliform counts and total coliform counts obtained from dry weather flow sampling are shown in Tables 4 and 5, respectively.

Samples have also been taken in the Spokane River during storm periods. Tables 6 and 7 show results of samples taken on summer days with periodic rain-shower activity.

TABLE 4

DRY WEATHER FLOW FECAL COLIFORM COUNTS - SPOKANE RIVER

LOCATION	COUNTS/100 ML									
	9-23-75	10- 1-76	6-1-76	6-7-76	6-14-76	9-13-76	10-12-76	10-18-76	11-8-76	11-15-76
UPRIVER POWER PLANT ABOVE ALL OVERFLOWS		LT30	40	LT30	LT30	LT30	LT30	LT30	LT30	LT30
TRENT STREET BRIDGE BETWEEN 034 & 035	LT30	LT30	LT30	90	230	18	LT30	8	3	1
FOREBAY AT WALL STREET BETWEEN 030 & 031	40	LT30	2400	2400	930	32	24	15	18	16
UPSTREAM FROM HANGMAN CREEK AT SNOW DUMP JUST BELOW 021	230	70	2400	11000	750	100	10	22	35	4
FORT WRIGHT BRIDGE JUST ABOVE 010	90	LT30	24000	2400	930	67	40	27	37	34
ABOVE TREATMENT PLANT BETWEEN 004 & 006	LT30	LT30	4600	4600	930	59	14	46	18	16
RIVERSIDE STATE PARK BELOW TREATMENT PLANT AND ALL OVERFLOWS			11000	11000	11000	27	LT30	30		
SEVEN MILE BRIDGE			4600	2400	4600	50	LT30	40		
NINE MILE BRIDGE			2400	2400	430	18	LT30	230		
UPPER LONG LAKE			1500	1500	930	90	LT30	LT30		
LOWER LONG LAKE			930	430	LT30	LT30				

NOTE: Samples taken on June 1, 7 & 14 affected by dry weather discharges of sanitary sewage at overflow points 032, 034 & 035. These dry weather discharges are caused by high river levels backing up into interceptor sewer forcing closure of gates to interceptor

TABLE 5

DRY WEATHER FLOW TOTAL COLIFORM COUNTS - SPOKANE RIVER

LOCATION	COUNTS/100 ML									
	9-23-75	10-1-75	6-1-76	6-7-76	6-14-76	9-13-76	10-12-76	10-18-76	11-8-76	11-15-76
UPRIVER POWER PLANT ABOVE ALL OVERFLOWS		LT30	150	LT30	LT30	LT30	LT30	LT30	LT30	LT30
TRENT STREET BRIDGE BETWEEN 034 & 035	LT30	LT30	LT30	230	2400	41	50	62	54	6
FOREBAY AT WALL STREET BETWEEN 030 & 031	90	111	2400	11000	11000	100	70	25	69	50
UPSTREAM FROM HANGMAN CREEK AT SNOW DUMP JUST BELOW 021	230	430	2400	24000	4600	100	111	136	100	33
FORT WRIGHT BRIDGE JUST ABOVE 010	150	150	24000	2400	4600	173	288	96	67	78
ABOVE TREATMENT PLANT BETWEEN 004 & 006	40	70	4600	4600	4600	195	311	144	63	37
RIVERSIDE STATE PARK BELOW TREATMENT PLANT AND ALL OVERFLOWS			24000	11000	24000	180	30	150		
SEVEN MILE BRIDGE			4600	2400	4600	267	90	70		
NINE MILE BRIDGE			2400	4600	4600	265	90	230		
UPPER LONG LAKE			1500	4600	4600	430	90	40		
LOWER LONG LAKE			930	930	40	LT30				

NOTE: Samples taken on June 1, 7 & 14 affected by dry weather discharges of sanitary sewage at overflow points 032, 034 & 035. These dry weather discharges are caused by high river levels backing up into interceptor sewer forcing closure of gates to interceptor

TABLE 6

WET WEATHER FLOW FECAL COLIFORM COUNTS - SPOKANE RIVER

LOCATION	COUNTS/100 ML						
	6-21-76	7-6-76	7-12-76	8-9-76	8-16-76	8-23-76	10-25-76
UPRIVER POWER PLANT ABOVE ALL OVERFLOWS	40	LT30	LT30	LT30	40	40	LT30
TRENT STREET BRIDGE BETWEEN 034 & 035	4600	430	930	9	19	36	7
FOREBAY AT WALL STREET BETWEEN 030 & 031	930	930	90	28	40	65	35
UPSTREAM FROM HANGMAN CREEK AT SNOW DUMP JUST BELOW 021	4600	430	230	97	140	80	59
FORT WRIGHT BRIDGE JUST ABOVE 010	2400	90	90	136	327	80	173
JUST ABOVE TREATMENT PLANT BETWEEN 004 & 006	11000	11000	2400	133	666	111	50
RIVERSIDE STATE PARK BELOW TREATMENT PLANT AND ALL OVERFLOWS	24000	1500	930	150	10	50	7
SEVEN MILE BRIDGE	4600	930	430	88	35	230	40
NINE MILE BRIDGE	2400	70	430	230	90	LT30	LT30
UPPER LONG LAKE	4600	40	230	230	430	70	LT30
LOWER LONG LAKE	LT30	LT30	LT30	LT30	LT30	LT30	

TABLE 7

WET WEATHER FLOW TOTAL COLIFORM COUNTS - SPOKANE RIVER

LOCATION	COUNTS/100 ML						
	6-21-76	7-6-76	7-12-76	8-9-76	8-16-76	8-23-76	10-15-76
UPRIVER POWER PLANT ABOVE ALL OVERFLOWS	200	LT30	LT30	40	40	90	40
TRENT STREET BRIDGE BETWEEN 034 & 035	4600	430	4600	150	40	66	56
FOREBAY AT WALL STREET BETWEEN 030 & 031	2400	930	90	156	106	383	90
UPSTREAM FROM HANGMAN CREEK AT SNOW DUMP JUST BELOW 021	4600	930	230	333	1434	300	188
FORT WRIGHT BRIDGE JUST ABOVE 010	4600	230	150	1533	8600	266	1200
JUST ABOVE TREATMENT PLANT BETWEEN 004 & 006	24000	24000	2400	3666	733	407	589
RIVERSIDE STATE PARK BELOW TREATMENT PLANT AND ALL OVERFLOWS	24000	1500	2400	1074	185	360	189
SEVEN MILE BRIDGE	11000	930	430	1222	1028	1500	40
NINE MILE BRIDGE	11000	150	430	2400	930	2400	90
UPPER LONG LAKE	11000	230	230	2400	930	430	90
LOWER LONG LAKE	40	LT30	LT30	LT30	LT30	40	

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Results of more intense sampling during storm runoff events is shown in the following two graphs (Figures 1 and 2). These graphs show the coliform counts in the Spokane River within the City, caused by storm runoff. Figure 1 shows the results of sampling during a rainstorm on November 17, 1974, comparing throughout the storm period the coliform counts in the river at the east city limits to those 2000 feet below the Meenach Drive Overflow (010) near the west city limits. Figure 2 shows the coliform counts in the river resulting from steady runoff into the river during the sampling period. The steady runoff resulted from snow melt during the day of February 13, 1975. The approximate flow time of the river was determined from USGS records and a theoretical block of water was followed through town with the effect from each overflow point passed being monitored.

FIGURE 1

COLIFORM COUNTS TAKEN IN SPOKANE RIVER DURING
RAINSTORM OF NOVEMBER 17, 1974

Indicates extent of pollution caused by overflows between east City limits and Meenach Drive overflow (No. 010)
Average flow in river = 2470 cfs

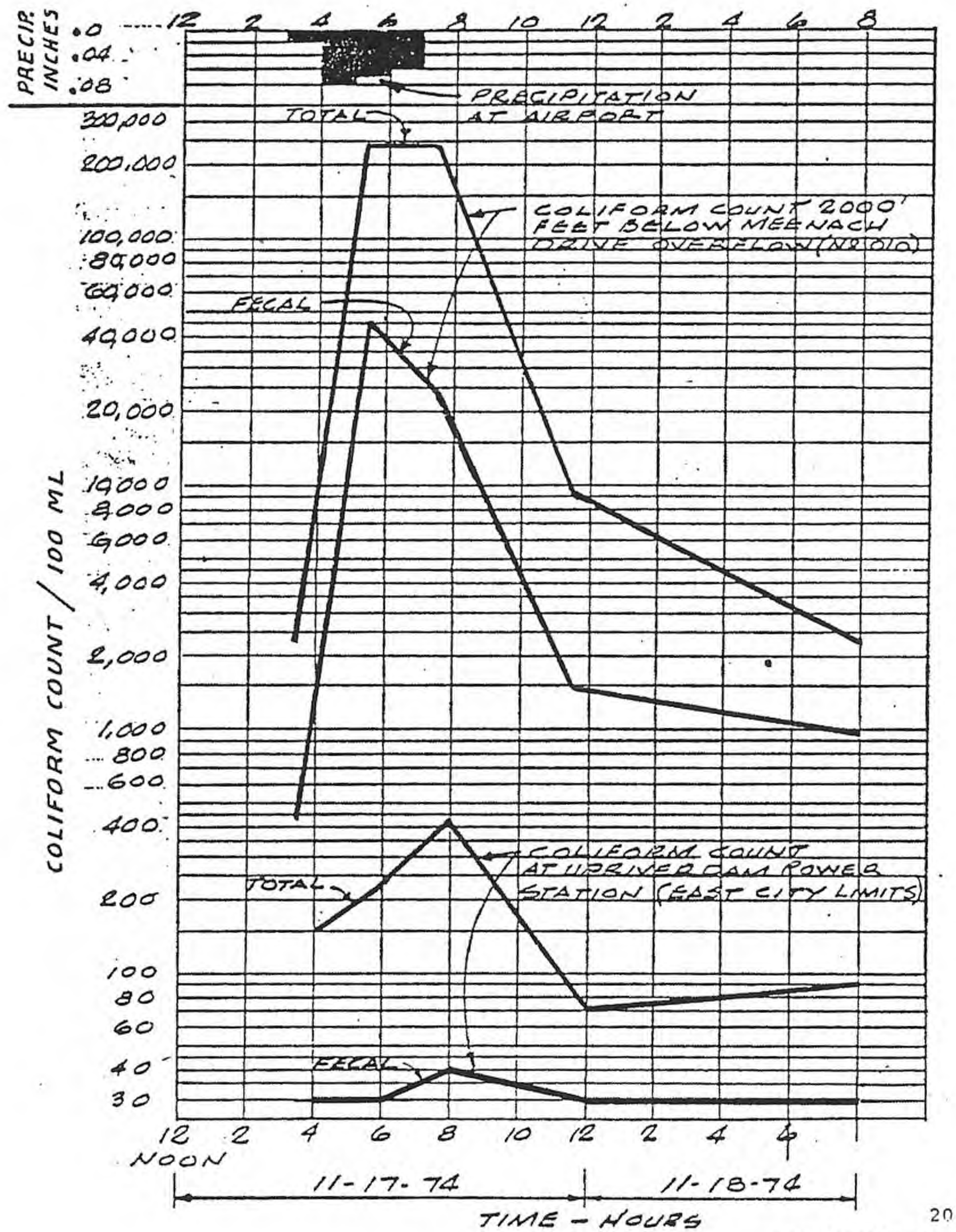
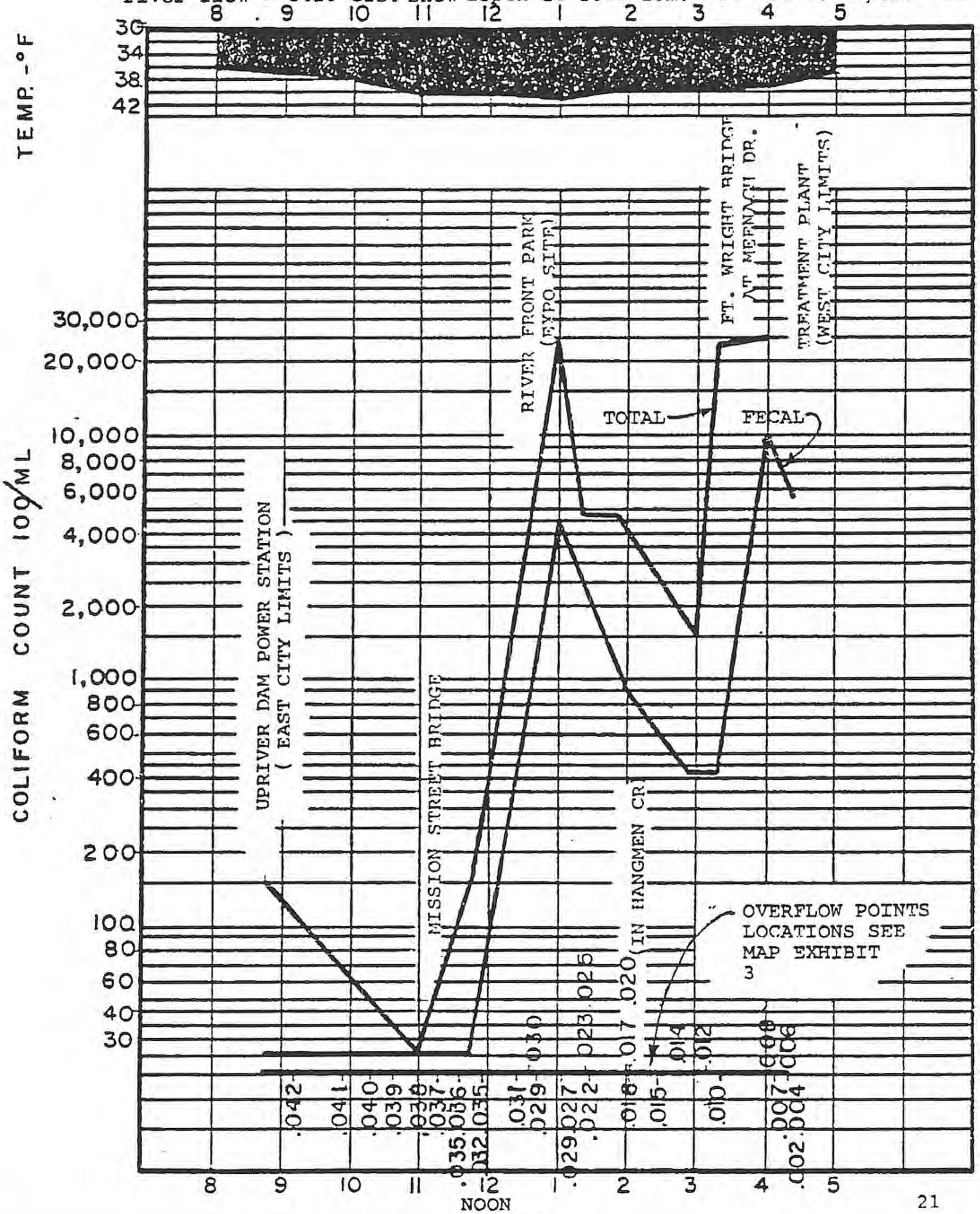


FIGURE 2

COLIFORM COUNTS TAKEN IN SPOKANE RIVER DURING PERIOD OF STEADY RUNOFF FROM SNOWMELT ON FEBRUARY 13, 1975

Samples taken based on flow time of river by following theoretical block of water from east city limits to west city limits. Average river flow = 3420 cfs. Snow depth at 1:00 a.m. = 14" at 4:00 p.m. = 11"



EXISTING SEWER SYSTEM AND FLOWS

A partial description of the sewer system for the City of Spokane is included in the "Planning Area and Description" section of this report. For additional information Table 8 shows the sizes and number of miles of sewer piping within the City. Exhibit 4 is a map showing the locations of existing trunk sanitary or combined sewers. Exhibit 5 is a map showing the locations of existing storm sewers. Exhibit 6 presents a schematic of the City's trunk and interceptor sewer systems showing existing capacity, flow, and overflow information.

TABLE 8

PRESENT SEWER MILEAGE - CITY OF SPOKANE

SANITARY SEWERS OR COMBINED STORM AND SANITARY SEWERS

Pipe Size	Miles	Pipe Size	Miles
6"	15.85	48"	2.34
8"	239.38	54"	2.30
10"	105.39	60"	2.72
12"	68.65	63"	.25
14"	.57	66"	2.20
15"	30.33	69"	.24
16"	.61	72"	.28
18"	19.33	3'6" X 5'3"	.38
20"	3.65	3'9" X 5'3"	.13
21"	9.51	4'6" X 6'9"	.14
22"	1.97	4'9" X 7'1.5"	.16
24"	15.82	5' X 7'6"	.49
27"	8.33	5'6" X 8'3"	.98
30"	8.27	5'9" X 8'7.5"	.18
33"	.04	6'7.5" X 9'11"	.56
36"	12.37	7'6" X 11'3"	.86
39"	.08	6' X 12'	.15
42"	4.71	Total Sanitary or Combine Sewer Mileage	559.22

SEPARATE STORM SEWERS

Pipe Size	Miles	Pipe Size	Miles
8"	15.49	27"	.60
10"	6.16	30"	2.01
12"	7.17	36"	1.49
15"	7.85	42"	.27
18"	6.70	48"	.30
20"	.36	60"	.31
21"	3.64	66"	.13
24"	4.70	69"	.26
		Total Storm Sewer Mileage	57.44

INFILTRATION AND INFLOW INFORMATION

Infiltration is the only applicable item to be discussed in this section, since the only significant inflow to the City's sewer system is storm runoff into street catch basins, and it is this inflow that this entire report is addressing. Most of the topography and types of soils found in the City of Spokane are not conducive to creating high ground water and spring areas which could create infiltration problems to adjacent sewer lines. There are, however, certain areas on the south side of the City which do experience some infiltration. Detailed information can be obtained concerning this infiltration from an infiltration/inflow report done for the City by Bovay Engineers, Inc., in June 1974.[5] In this report it was determined that excessive infiltration did not exist for construction of the City's secondary sewage treatment plant. This conclusion is even more true when considering projects which will eliminate combined sewer overflows. The amount of flow in the City's sewer system from infiltration is so insignificant when compared to storm flows that elimination of infiltration would not provide for any reductions in costs for combined sewer overflow projects.

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[5] Bovay Engineers, Inc., Consulting Engineers, Report on Excessive Infiltration/Inflow, June 1974, pp. V-2 through V-5 and Table 6.

ELIMINATING DRY WEATHER SANITARY SEWAGE DISCHARGES TO THE SPOKANE RIVER

As described earlier in this report, in the Spring when river levels are high, Overflow Points 032 (Erie Street), 034 (Front Avenue), and 035 (Mallon Avenue) discharge dry weather sanitary sewage flow to the Spokane River. Eliminating this condition is a first priority.

The proposed solution at Overflow Points 032 and 035 is to re-adjust various weir settings in the interceptor sewer system so these overflow points can be eliminated completely with all discharges going directly to the interceptor sewer. This can be accomplished at 032 by eliminating the two weir chambers and at 035 by installing 80 feet of 27 inch sewer pipe in addition to eliminating the weir chamber. This proposal will provide for a permanent solution of both wet and dry weather overflows at these two overflow points.

Solving the dry weather overflow problem at Overflow Point 034 is more complex because the potential wet weather discharges from this overflow are much too high to be handled with a direct connection to the interceptor sewer. Solutions for wet weather overflows, as described later in this report, would permanently solve this dry weather discharge problem, but from a realistic standpoint, it is doubtful that enough money will be available immediately to eliminate all wet weather overflows. Instead, overflows will have to be eliminated on a priority basis, and as shown later in this report, Overflow Point 034 is low enough in priority so that money probably will not be available immediately for solving this wet weather overflow problem. Conse-

quently, an immediate solution to the dry weather discharges at Overflow Point 034 is proposed.

The proposed solution at 034 is to abandon the present weir chamber and build a new one at the intersection of Riverside Avenue and Crestline Street. This new location is far enough upstream from the river so that it will not be affected by high river elevations. All dry weather flow would be diverted at the weir chamber into a new 36 inch sewer, which would replace an old existing 24 inch sewer built in 1909. The 24 inch sewer would not be adequate to accept all dry weather flow which at present is mostly carried in a parallel 66 inch sewer. The new 36 inch sewer would connect directly to the interceptor. Overflows, during storm periods, would be carried to the river in the 66 inch sewer. In addition, 20 side sewer connections would have to be changed over from the 66 inch sewer to the new 36 inch sewer. Also a new 8 inch sewer with a weir manhole would be constructed in Riverside Avenue between Pittsburg Street and Magnolia Street so that sanitary flow from a 12 inch sewer on Riverside Avenue can enter the new 36 inch sewer while storm flow can still enter the 66 inch sewer.

Exhibit 6, "Present Flow Conditions in Trunk and Interceptor Sewer Systems," and Exhibit 7, "Proposed Flow Conditions in Trunk and Interceptor Sewer Systems," show flow conditions in the trunk and interceptor systems at present and after the proposed changes to eliminate dry weather overflows at Overflow Points 032, 034, and 035.

Exhibit 8 is a map showing the existing sewer systems at Overflow Points 032, 034, and 035. Exhibit 9 is a map showing the proposed sewer systems at these same overflow points after changes have been made to eliminate dry weather overflows.

Costs for eliminating the previous dry weather discharges are as follows:

OVERFLOW POINT	DESCRIPTION OF WORK	COSTS
032	Eliminate the two existing weir chambers and abandon outfall to the river	$ 1,000
034	Abandon existing weir chamber, construct new weir chamber, construct new weir manhole, construct 4,250 feet of 36 inch sewer pipe and 360 feet of 8 inch sewer pipe, and reconnect 20 side sewer connections	535,000
035	Construct 80 feet of new 27 inch sewer to interceptor, eliminate existing weir chamber, and abandon outfall to the river	4,000
	TOTAL CONSTRUCTION COSTS	$540,000
	ENGINEERING, INSPECTION, ADMINISTRATIVE AND LEGAL COSTS	60,000
	TOTAL COSTS	$600,000

ELIMINATING WET WEATHER COMBINED STORM AND SANITARY SEWAGE OVERFLOWS TO THE SPOKANE RIVER

GENERAL

The prime purpose of this report is to determine the most cost effective City wide solution for correcting wet weather combined storm and sanitary sewer overflows to the Spokane River. This section will discuss various alternate solutions to the problem.

LIST OF ALTERNATES STUDIED

Alternate 1

Alternate 1 consists of constructing storage basins at key overflow point locations along the Spokane River so that overflow discharges could be stored during storm runoff periods. The stored sanitary sewage and storm water would be released for treatment at the City's sewage treatment plant after the storm runoff subsides.

Alternate 2

Alternate 2 consists of constructing satellite treatment facilities located at key overflow point locations along the Spokane River so that all overflows can be treated on site prior to discharge to the river.

Alternate 3

Alternate 3 consists of constructing separate storm sewers. This would provide for storm and sanitary sewer separation thereby eliminating sanitary sewage in storm-water discharges to the Spokane River.

Alternate 4

Alternate 4 consists of constructing a second sewer interceptor, parallel to the existing interceptor system. All overflow discharges would be conveyed to the City's main sewage treatment plant which would have to be greatly enlarged to treat all incoming flows. Previous studies indicate that solving the problem using only this alternate would be far too costly and impractical.[6] Therefore, after brief study, this alternate was dropped from consideration.

Alternate 5

Alternate 5 would consist of trying to optimize the operation of the existing sewer system. This could be done by monitoring and regulating flows in the sewer system to take advantage of maximum possible system capacity. A brief analysis showed that this technique alone would not significantly reduce combined sewer overflows, but this concept will be used in conjunction with the other alternates.

Combination of Alternates

On a City-wide basis, combinations of the above alternates could have proved to be the most cost effective solution to the overall problem. However, cost information presented in Table 17 indicates that this is not the case for this particular study.

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[6]Esvelt and Saxon/Bovay Engineers Inc., Consulting Engineers Spokane Waste Water Study, July 1972, p. 32.

DESCRIPTIONS AND DESIGN CONSIDERATIONS FOR ALTERNATIVES 1, 2 AND 3

Alternate 1 (Storage Basins)

The storage basins under this alternate would be underground concrete tanks constructed at selected overflow point locations to store excess combined sewage until interceptor capacity is available to drain the basins. The basins would be located underground for three important reasons:

1. Aesthetics - Land areas required for storage basins would be from less than 1 acre to 10 acres. Visible basins of this magnitude along the Spokane River would be a detriment to the scenic beauty of the river and surrounding areas.
2. Gravity Inflow - It is extremely important to avoid pumping of storm water due to the very large pump stations which would be required along with the high power and other operation and maintenance costs associated with large pump stations. Therefore, the basins would be located deep enough to provide gravity inflow. It is also desirable to have gravity outflow, which most of the basins proposed in the report have, but the pumping of outflow, if required, is not a big item since outflow would be metered out slowly and the amount of flow to be pumped would be relatively small.
3. Available Right of Way - The density of development within the City and the large sizes required for storage basins makes siting very difficult. Due to the limited number of sites available, portions of basins would have to be located under existing improvements, such as street right of way, park land, etc. Therefore, basins would have to be below ground so that surface land can be restored to its original use.

Interceptor sewer capacity would be used to the maximum possible extent with only excess flows being stored. Following the storm period when flows in the interceptor system begin to subside, stored sewage would be released from the storage basins to keep maximum possible flow in the interceptor system or until the storage basins are emptied. Each storage basin within the City would take about 24 hours to empty if

fully loaded. A central monitoring station at the main treatment plant would remotely monitor and control inflow, outflow, and water elevations in the storage basins and flow conditions in the interceptor system. Any excess flows that the storage basins and interceptor system cannot handle would have to be dumped directly to the Spokane River.

This report will present three different City wide storage basin plans which will be referred to as Storage Plan A, B, and C, respectively. Under each plan, storage basins sized to contain the critical 5-year, 10-year, 25-year, or 50-year storms will be considered. Regardless of the size of storage basins selected, this concept would provide a means to collect almost all combined storm and sanitary sewage runoff for treatment at the City's main treatment plant, but periodic overflows to the Spokane River could occur. The frequency and amount of overflows would depend on the sizes of storage basins selected.

The volume of storage required for each basin was computed by routing runoff from design storms of varying durations and intensities through the storage basin. Variables accounted for in the sizing process were rainfall amounts for 5, 10, 25, and 50-year storms, soil infiltration rates, total pervious and impervious drainage basin areas, and allowable outlet capacity of each storage basin so that the interceptor sewer system can be used to the maximum possible extent. Limited interceptor capacity was reserved for future sanitary flows from certain areas within the City or County, such as the Beacon Hill

area, Glenrose, Moran Prairie, Thorpe Road, Indian Trail, Cozza Calkins, etc.

Rainfall frequency curves used in the analysis are shown in Exhibit 10. Infiltration rate curves are shown in Exhibit 11. Exhibits 12, 13 and 14 are maps showing the locations for the storage basins and interconnecting piping for Storage Plans A, B, and C, respectively. Tables 9, 10, and 11 list the sizes required for each storage basin along with other detailed information for each storage plan. It should be noted here that under all alternates, Overflow Points 029, 032, and 035 would be eliminated by direct connection to the interceptor and 036 by constructing 300 feet of 10 inch storm sewer.

TABLE 9
STORAGE PLAN A

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches) (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. 10 yr. 25 yr. 50 yr. (Million Gallons)
1A	Surro Drive	042	64 / 15	(Gravity) 8.29 / .73 (Gravity)	———	.36 / .49 / .63 / .72
2A	Rebecca St.	041	100 / 24	(Gravity) 22.73 / 1.17 (Gravity)	———	.57 / .78 / 1.01 / 1.16
3A	Regal Street	040	51 / 12	(Gravity) 8.20 / .58 (Gravity)	———	.29 / .39 / .51 / .58
4A	Altamont St.	039	49 / 12	(Gravity) 6.55 / .58 (Gravity)	———	.29 / .39 / .51 / .58
5A	Magnolia St.	038	60 / 14	(Gravity) 10.61 / .68 (Gravity)	———	.33 / .46 / .59 / .68

TABLE 9
STORAGE PLAN A (Cont.)

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches) (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. (Million Gallons)
6A	Sharp Ave.	037	121 / 29	(Gravity) 8.87 / 1.41 (Pumped)	———	.69 / .95 / 1.22 / 1.40
7A	Erie Street	032,033, 034	3635 / 872	(Pumped) 264.13 / 42.49 (Gravity)	———	20.78 / 28.66 / 36.76 / 42.09
8A	Astor at Desmet	031	34 / 8	(Gravity) 4.45 / .39 (Pumped)	———	.19 / .26 / .34 / .39
9A	Washington St	030	645 / 181	(Gravity) 14.70 / 8.82 (Pumped)	———	4.31 / 5.95 / 7.63 / 8.74
10A	Monroe Street	027	86 / 21	(Gravity) 5.15 / 1.02 (Pumped)	———	.50 / .69 / .89 / 1.01

TABLE 9
STORAGE PLAN A (Cont.)

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches) (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. 10 yr. 25 yr. 50 yr. (Million Gallons)
11A	Cedar - North of River	023	181 / 43	(Gravity) 7.59 / 2.10 (Gravity)	———	1.02 1.41 1.81 2.08
12A	Cedar - South of River	024,025, 026	2142 / 845	(Gravity) 451.20 / 41.17 (Pumped)	24 .35 48 .25 66 .10	20.13 27.77 35.62 40.78
13A	Elm Street	022B	35 / 8	(Gravity) 3.13 / .39 (Pumped)	———	.19 .26 .33 .39
14A	South Manito	020	529 / 127	(Gravity) 43.67 / 6.19 (Pumped)	———	3.03 4.17 5.35 6.13
15A	Seventh Ave. @ Canyon Hill	019	49 / 12	(Gravity) 10.88 / .58 (Gravity)	———	.29 .39 .51 .58

TABLE 9
STORAGE PLAN A (Cont.)

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches) (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. 10 yr. 25 yr. 50 yr. (Million Gallons)
16A	High Bridge Park	016,017	313 75	(Gravity) 52.40 3.65 (Pumped)	———	1.79 2.47 3.16 3.62
17A	Ohio Avenue	015	135 32	(Gravity) 10.11 1.56 (Gravity)	———	.76 1.05 1.35 1.54
18A	Sherwood @ Summit	014	74 18	(Gravity) 11.16 .88 (Pumped)	———	.43 .59 .76 .87
19A	Nora @ Pettet Drive	012	394 95	(Gravity) 47.45 4.63 (Gravity)	———	2.26 3.12 4.00 4.59
20A	Meenach Dr.	010	5271 1265	(Gravity) 726.72 30.00 (Pumped)	———	40.88 54.05 65.59 74.99

TABLE 9
STORAGE PLAN A (Cont.)

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches) (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. (Million Gallons)
21A	Columbia Circle	007	129 / 31	(Gravity) 4.19 / 1.51 (Gravity)	———	.74 / 1.02 / 1.31 / 1.50
22A	Garland Ave.	006	635 / 156	(Gravity) 74.73 / 7.60 (Gravity)	———	3.72 / 5.13 / 6.58 / 7.53
23A	Hollywood	003	1157 / 278	(Gravity) 107.00 / 13.55 (Gravity)	———	6.62 / 9.14 / 11.72 / 13.42
24A	Hartley St.	002	84 / 20	(Gravity) 5.81 / .97 (Gravity)	———	.48 / .66 / .84 / .97

TABLE 10
STORAGE PLAN B

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches) (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. (Million Gallons)
1B	Surro Drive	042	64 / 15	(Gravity) 8.29 / .73 (Gravity)	———	.36 / .49 / .63 / .72
2B	Rebecca St.	041	100 / 24	(Gravity) 22.73 / 1.17 (Gravity)	———	.57 / .78 / 1.01 / 1.16
3B	Magnolia St.	038,039, 040	160 / 38	(Gravity) 24.20 / 1.85 (Gravity)	27 .35 36 .45	.91 / 1.25 / 1.60 / 1.83
4B	Sharp Avenue	037	121 / 29	(Gravity) 8.87 / 1.41 (Pumped)	———	.69 / .95 / 1.22 / 1.40
5B	Erie Street	032,033, 034	3635 / 872	(Pumped) 264.13 / 42.49 (Gravity)	———	20.78 / 28.66 / 36.76 / 42.09

TABLE 16
STORAGE PLAN B (Cont.)

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. (Million Gallons)
6B	Washington St	030,031	679 / 189	(Gravity) 18.76 / 9.21 (Pumped)	15	.50	4.50 / 6.21 / 7.97 / 9.12
7B	Cedar - North of River	023,027	267 / 64	(Gravity) 11.72 / 3.12 (Gravity)	21	.30	1.52 / 2.10 / 2.70 / 3.09
8B	Cedar - South of River	024,025 026,022B	2177 / 853	(Gravity) 453.94 / 41.17 (Pumped)	10 24 48 66	.30 .35 .25 .10	20.23 / 28.03 / 35.96 / 41.17
9B	So. Manito	020	529 / 127	(Gravity) 43.67 / 6.19 (Pumped)	——		3.03 / 4.17 / 5.35 / 6.13
10B	Highbridge Park	016,017, 019	362 / 87	(Gravity) 62.70 / 4.63 (Pumped)	21	.65	2.26 / 3.12 / 4.00 / 4.59

TABLE 10
STORAGE PLAN B (Cont.)

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. (Million Gallons)
11B	Ohio Avenue	014,015	209 / 50	(Gravity) 20.39 / 2.44 (Gravity)	24	.50	1.19 / 1.64 / 2.11 / 2.41
12B	Meenach Drive	010,012	5665 / 1360	(Gravity) 769.54 / 34.63 (Pumped)	24	.65	43.14 / 57.17 / 69.59 / 79.58
13B	Columbia Circle	007	129 / 31	(Gravity) 4.19 / 1.51 (Gravity)	—		.74 / 1.02 / 1.31 / 1.50
14B	Garland Ave.	006	635 / 156	(Gravity) 74.73 / 7.60 (Gravity)	—		3.72 / 5.13 / 6.58 / 7.53
15B	Hollywood	002,003	1241 / 298	(Gravity) 111.84 / 14.52 (Gravity)	21	.50	7.10 / 9.79 / 12.56 / 14.38

TABLE 11
STORAGE PLAN C

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches) (miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. 10 yr. 25 yr. 50 yr. (Million Gallons)
1C	Surro Drive	042	64 / 15	(Gravity) 8.29 / .73 (Gravity)	———	.36 / .49 / .63 / .72
2C	Rebecca St.	041	100 / 24	(Gravity) 22.73 / 1.17 (Gravity)	———	.57 / .78 / 1.01 / 1.16
3C	Sharp Ave.	037	121 / 29	(Gravity) 8.87 / 1.41 (Pumped)	———	.69 / .95 / 1.22 / 1.40
4C	Erie Street	032,033, 034,038, 039,040	3795 / 910	(Pumped) 287.65 / 44.34 (Gravity)	27 .35 36 .45 42 1.15	21.68 / 29.91 / 38.36 / 43.92
5C	Washington St	030,031	679 / 189	(Gravity) 18.76 / 9.21 (Pumped)	15 .50	4.50 / 6.21 / 7.97 / 9.12

TABLE 11
STORAGE PLAN C (Cont.)

STORAGE BASIN NO.	STORAGE BASIN LOCATION	OVERFLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	FLOW CAPACITY AT STORAGE BASIN Inlet / Outlet (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size-Length (inches)	(miles)	STORAGE BASIN SIZES Storm Freq. 5 yr. 10 yr. 25 yr. 50 yr. (Million Gallons)
6C	Ohio Avenue	014,015, 023,027	476 / 114	(Gravity) 30.01 / 5.55 (Pumped)	18 21 24 24	.30 .30 1.00 .50	2.72 3.75 4.81 5.50
7C	Highbridge Park	016,017, 019,022B, 024,025, 026	2539 / 940	(Gravity) 475.47 / 45.80 (Pumped)	21 24 48 66 90	.65 .75 .25 .10 1.05	22.40 30.90 39.63 45.37
8C	South Manito	020	529 / 127	(Gravity) 43.67 / 6.19 (Pumped)	——		3.03 4.17 5.35 6.13
9C	Meenach Drive	007,010, 012	5794 / 1391	(Gravity) 772.22 / 36.14 (Pumped)	24 15	.65 .90	43.88 58.19 70.90 81.08
10C	Hollywood	002,003, 006	1876 / 454	(Gravity) 178.97 / 22.12 (Gravity	21 36	.50 .50	10.82 14.92 19.14 21.91

Alternate 2 (Satellite Treatment Facilities)

Under this alternate satellite treatment facilities, to provide on site treatment for combined sewer overflows, would be located at the same locations and governed by the same aesthetics, gravity inflow and outflow, and right of way criteria as proposed for the storage basins in Alternate 1. The capacity of the interceptor sewer system and main sewage treatment plant would be used to the maximum possible extent. Excess flows would be treated at the satellite treatment facilities and discharged directly to the Spokane River. The treatment facilities would be required to operate only during storm runoff periods and therefore would remain idle much of the time. Reliability would be important since plant failure would mean that untreated overflows would go into the river as they do under present conditions. A central monitoring station would be set up at the main sewage treatment plant to monitor and control the operation of the treatment facilities and interceptor sewer system.

As with the storage alternate, three plans will be considered and referred to as Satellite Treatment Plan A, B, and C, respectively. Unlike the storage basins which were sized for maximum volumes, the treatment facilities would have to be sized for peak flows. The maximum volumes computed for the storage basins would occur from storms with long durations. Rainfall intensities for these long duration storms are low enough so that peak flows generated by 5, 10, 25 or 50-year storms do not exceed the capacity of the existing trunk sewer system. On the other hand, the peak flows that the treatment facilities would

have to be sized for would occur from shorter duration higher intensity rainstorms. These higher intensity storms generate peak flows that would exceed the flow capacity of many trunk sewers within the City for greater than 5 or 10 year frequency storms unless a relief sewer system is built (discussed later in report). Treatment facilities sized for 5, 10, 25, and 50-year storms will be presented in this report even though relief sewers would be needed in many cases for the higher frequency storms. Peak flows were computed using the rational formula method as described for Alternate 3 (Storm Sewers).

An analysis of satellite treatment facilities has been done previously and is presented in the "Spokane Waste Water Study."[7] Rather than duplicate the work that has already been done, this report will rely on the information already available regarding satellite treatment plants and make modifications where necessary. The equivalent of primary treatment of overflows is proposed, and the information presented in the "Spokane Waste Water Study" indicates that the most economical approach is to use compact, in-line, high rate treatment methods. This involved using a package plant system employing screening and chlorination.

Exhibits 12, 13, and 14 show the locations for the treatment facilities and interconnecting piping for Treatment Plans A, B, and C, respectively. Tables 12, 13, and 14 list the capacity required for each treatment facility along with other detailed information.

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[7]Esvelt and Saxon/Bovay Engineers Inc., Consulting Engineers, Spokane Waste Water Study, July 1972, p. 32.

TABLE 12

SATELLITE TREATMENT PLAN A

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Inter-ceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches) Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. 10 yr. 25 yr. 50 yr. Peak Flo (cfs)
1A	Surro Dr.	042	64 15	8.29 .73	———	6.07 7.87 10.27 11.77
2A	Rebecca St.	041	100 24	22.73 1.17	———	11.03 14.63 18.33 20.73
3A	Regal St.	040	51 12	8.20 .58	———	6.72 8.72 10.92 14.22
4A	Altamont St.	039	49 12	6.55 .58	———	6.52 8.32 10.42 11.72
5A	Magnolia St	038	60 14	10.61 .68	———	7.92 10.22 12.82 14.42

TABLE 12
SATELLITE TREATMENT PLAN A - (Cont.)

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Inter-ceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches) Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr / 25 yr / 50 yr Peak Flow (cfs)
6A	Sharp Ave.	037	121 / 29	8.87 / 1.41	———	13.49 / 17.69 / 22.19 / 25.09
7A	Erie Street	032,033, 034	3635 / 872	264.13 / 42.49	———	202.91 / 273.81 / 339.21 / 393.71
8A	Astor at Desmet	031	34 / 8	4.45 / .39	———	4.51 / 5.81 / 7.31 / 8.21
9A	Washington Street	030	645 / 181	14.70 / 8.82	———	38.68 / 52.58 / 67.68 / 78.08
10A	Monroe St.	027	86 / 21	5.15 / 1.02	———	9.98 / 13.08 / 16.48 / 18.58

TABLE 12
SATELLITE TREATMENT PLAN A (Cont.)

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Interceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. Peak Flow (cfs)
11A	Cedar - No. of River	023	181 / 43	7.59 / 2.10	———		12.2 / 16.9 / 21.3 / 25.4
12A	Cedar - So. of River	024,025, 026	2142 / 845	451.2 / 41.17	48 66	.25 .10	280.1 / 310.1 / 400.2 / 500.3
13A	Elm Street	022B	35 / 8	3.13 / .39	———		5.5 / 7.0 / 8.7 / 9.7
14A	South Manito	020	529 / 127	43.67 / 6.19	———		28.8 / 38.5 / 49.1 / 56.4
15A	Seventh Ave. @ Canyon Hill	019	49 / 12	10.88 / .58	———		5.6 / 7.5 / 9.4 / 10.6

TABLE 12
SATELLITE TREATMENT PLAN A (Cont.)

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Inter-ceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches) Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. Peak Flow (cfs)
16A	Highbridge Park	016,017	313 / 75	52.40 / 3.65	———	24.1 / 32.3 / 40.0 / 48.1
17A	Ohio Avenue	015	135 / 32	10.11 / 1.56	———	15.0 / 19.9 / 25.0 / 28.3
18A	Sherwood @ Summit	014	74 / 18	11.16 / .88	———	8.4 / 11.2 / 14.1 / 15.9
19A	Nora @ Pettet Dr.	012	394 / 95	47.45 / 4.63	———	44.5 / 59.1 / 74.3 / 84.1
20A	Meenach Dr.	010	5271 / 1265	726.72 / 30.00	———	270.8 / 310.1 / 390.3 / 500.9

TABLE 1-2
SATELLITE TREATMENT PLAN A - (Cont.)

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Inter-ceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches) Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. Peak Flow (cfs)
21A	Columbia Circle	007	129 / 31	4.19 / 1.51	———	17.4 / 22.4 / 28.2 / 31.7
22A	Garland Ave.	006	635 / 156	74.73 / 7.60	———	44.3 / 61.3 / 76.3 / 92.2
23A	Hollywood	003	1157 / 278	107.00 / 13.55	———	68.2 / 93.2 / 112.7 / 134.1
24A	Hartley St.	002	84 / 20	5.81 / .97	———	8.1 / 10.6 / 13.6 / 15.6

TABLE 13

SATELLITE TREATMENT PLAN B

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Inter-ceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. Peak Flow (cfs)
1B	Surro Drive	042	64 / 15	8.29 / .73	—		6.0 / 7.8 / 10.2 / 11.7
2B	Rebecca St.	041	100 / 24	22.73 / 1.17	—		11.0 / 14.6 / 18.3 / 20.7
3B	Magnolia St	038,039 040	160 / 38	24.20 / 1.85	27 36	.35 .45	18.0 / 23.6 / 29.7 / 33.6
4B	Sharp Ave.	037	121 / 29	8.87 / 1.41	—		13.4 / 17.6 / 22.1 / 25.0
5B	Erie Street	032,033, 034	3635 / 872	264.13 / 42.49	—		202.9 / 273.3 / 339.2 / 393.7

TABLE 13
SATELLITE TREATMENT PLAN B (Cont.)

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Interceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. Peak Flow (cfs)
6B	Washington Street	030,031	679 / 189	18.76 / 9.21	15	.50	41.5 54.9 70.6 82.7
7B	Cedar - No. of River	023,027	267 / 64	11.72 / 3.12	21	.30	18.1 25.1 31.7 37.8
8B	Cedar - So. of River	024,025, 026 022B	2177 / 853	453.94 / 41.17	10 48 66	.30 .25 .10	281.8 312.1 402.6 503.1
9B	South Manito	020	529 / 127	43.67 / 6.19	——		28.8 38.5 49.1 56.4
10B	Highbridge Park	016,017 019	362 / 87	62.70 / 4.63	21	.65	27.6 37.1 46.6 55.5

TABLE 13

SATELLITE TREATMENT PLAN B - (Cont.)

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Inter-ceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. Peak Flow (cfs)
11B	Ohio Avenue	014,015	209 / 50	20.39 / 2.44	24	.50	23.4 / 31.1 / 39.1 / 44.2
12B	Meenach Dr.	010,012	5665 / 1360	769.54 / 34.63	24	.65	310.9 / 350.8 / 460.0 / 510.7
13B	Columbia Circle	007	129 / 31	4.19 / 1.51	——		17.4 / 22.4 / 28.2 / 31.7
14B	Garland Ave.	006	635 / 156	74.73 / 7.60	——		44.0 / 61.3 / 76.3 / 92.2
15B	Hollywood	002,003	1241 / 298	111.84 / 14.52	21	.50	73.1 / 99.9 / 120.8 / 143.8

TABLE 14
SATELLITE TREATMENT PLAN C

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Interceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. / 10 yr. / 25 yr. / 50 yr. Peak Flow (cfs)
1C	Surro Drive	042	64 / 15	8.29 / .73	—	—	6.0 / 7.8 / 10.2 / 11.7
2C	Rebecca St.	041	100 / 24	22.73 / 1.17	—	—	11.0 / 14.6 / 18.3 / 20.7
3C	Sharp Ave.	037	121 / 29	8.87 / 1.41	—	—	13.4 / 17.6 / 22.1 / 25.0
4C	Erie Street	032,033, 034,038, 039,040	3795 / 910	287.65 / 44.34	27 / 36 / 42	.35 / .45 / 1.15	217.7 / 293.4 / 363.3 / 421.5
5C	Washington Street	030,031	679 / 189	18.76 / 9.21	15	.50	41.5 / 54.9 / 70.6 / 82.7

TABLE 14
SATELLITE TREATMENT PLAN C (Cont.)

SATELLITE TREATMENT PLANT NO.	TREATMENT PLANT LOCATION	OVER-FLOW POINTS SERVED	DRAINAGE BASIN AREA SERVED Total / Impervious (Acres)	PRESENT TRUNK SEWER FLOW CAPACITY Inlet / Outlet to Inter-ceptor (cfs)	PIPING REQUIRED TO INTERCONNECT DRAINAGE BASIN AREAS Size (inches)	Length (miles)	TREATMENT PLANT SIZES Storm Freq. 5 yr. 10 yr. 25 yr. 50 yr. Peak Flow (cfs)
6C	Ohio Avenue	014,015, 023,027	476 / 114	30.01 / 5.55	21 24 24	.30 1.00 .50	32.3 45.5 55.7 67.4
7C	Highbridge Park	016,017, 019,022B 024,025, 026	2539 / 940	475.47 / 45.80	21 48 66 90	.65 .25 .10 1.05	295.3 325.6 420.3 526.3
8C	South Manito	020	529 / 127	43.67 / 6.19	——		28.8 38.5 49.1 56.4
9C	Meenach Drive	007,010, 012	5794 / 1391	772.22 / 36.14	24 15	.65 .90	315.5 356.6 468.5 519.8
10C	Hollywood .48 .6 .72 .83	002,003 006	1876 / 454	178.97 / 22.12	21 36	.50 .50	117.3 152.2 187.0 219.0

Alternate 3 (Storm Sewers)

Storm sewers would be constructed in areas of the City not already part of a present storm sewer system. Available interceptor capacity would also be used for storm runoff to reduce the amount of storm sewer piping that would otherwise be required for complete separation. This reduced storm sewer system would eliminate sanitary sewage discharges to the Spokane River and most sewer backups into basements caused by storm runoff. Discharge of the storm sewers would be to the Spokane River through existing overflow points. Sanitary sewage at all times would flow to the interceptor sewer system and be treated at the City's sewerage treatment plant. The number of miles of storm sewers that would be constructed City-wide is 220.

The amount of sewer flow and rainfall data needed to develop an accurate unit Hydrograph analysis were not available for use in this study. Since time was not available to develop the necessary data for a unit hydrograph analysis, the design flows for the storm sewer systems were computed using the rational formula method (Q=CiA) and the rainfall frequency curves shown in Exhibit 10. The 5-year frequency curve was used and the runoff coefficients used ranged from (C=.15) for residential areas to (C=.90) for the downtown area. The above criteria has provided satisfactory results for sizing the 57 miles of storm sewers presently in use in the City of Spokane.

A minimum design velocity of 2.5 fps would be allowed in certain sections of the storm sewer system where there are adverse grade conditions. The majority of the storm sewer

system would, however, have velocities exceeding 3 fps. The depth of the storm sewer piping would be as shallow as possible, but enough depth would have to be provided to avoid conflicts with other existing utilities. The minimum depth used for storm sewers is 5 feet to the crown of the pipe with other depths deeper as required.

Standard construction methods can be used for constructing the storm sewers. The construction would take place in existing paved streets requiring removal and replacement of the pavement. Vehicular traffic would be re-routed around the construction areas. Shoring of trenches instead of sloping back trench walls would be used to keep trench widths to a minimum and provide for minimum disturbance to existing improvements. Less than 10 percent of the total excavation City wide is anticipated to be rock with the remainder being mostly sand and gravel.

Exhibit 15 is a map showing the locations for the storm sewer piping. Exhibits 16, 17, 18, and 19 are maps showing the pipe sizes for the storm sewer system. Also in certain areas existing large combined sewers would be used for storm sewer trunks with new smaller sewers being constructed for sanitary flows. Exhibit 20 shows the location for these new sanitary sewers.

Relief Sewers (Supplement to Alternates 1 and 2)

Many of the combined storm and sanitary trunk sewers in the City of Spokane do not have enough flow capacity to handle the full capacity of the subtrunk and lateral sewers which feed into them. No problems are encountered during dry weather flow, but during rainstorm periods this situation helps to create sewer backup problems. If, in addition to solving overflow problems, the Storage or Treatment Alternates are to also help alleviate sewer backup and drainage problems as does the storm Sewer Alternate, relief sewers would have to be built in certain areas of the City. Some trunk sewer systems within the City have capacities capable of carrying storm flows in excess of 25 and 50-year storm frequencies while others have capacities ranging down to as low as a 2-year frequency. These lower capacity trunk sewer systems would have to have parallel relief sewers built. The number of miles of relief sewers that would be constructed City-wide is about 55.

The proposed relief sewers would be constructed parallel to the existing trunk sewers at depths which provide minimum interference with existing utilities. The relief sewers would be interconnected at frequent intervals with the trunk sewers in order to obtain maximum flexibility and flow capacity within the relief-trunk system. The crown elevation of the relief sewers would be set equal to or lower than the crown elevation of the adjacent trunk sewers to avoid surcharging conditions.

The relief sewers were sized so that, when combined with the capacity of the existing trunk sewers, the trunk-relief system together could handle the flow from a 25-year frequency storm. The 25-year frequency storm is a common design parameter recommended for combined sewer systems and was selected to provide the maximum possible protection against sewer backups for the least possible costs.

The required capacity for the trunk-relief system was determined by using the rational formula method (Q=CiA) in the same manner as used for the Storm Sewer Alternate. A minimum flow velocity of 2.5 feet per second (fps) would be allowed in the new relief sewers in areas with adverse grade conditions. Velocities, in most of the relief sewers, however, would exceed 3 fps. A map showing the location of necessary relief sewers is shown in Exhibit 21.

Explanation of Design Rainfall/Frequency Data

The rainfall/frequency data used in this report is based on Weather Bureau data for maximum possible rainfall amounts for each storm frequency for the Spokane area (Exhibit 10). Table 15, which shows maximum rainfall amounts recorded for each month in the Spokane area, indicates that May thru September are the critical months in terms of determining maximum design storms. Since May thru September is the time of the year when water contact sports take place in the Spokane River and Long Lake, it is appropriate to use the rainfall/frequency data in Exhibit 10 for design purposes.

A 5 year design frequency was used for sizing storm

sewers since this is the most commonly accepted design parameter in use in this country as reported in most engineer publications. The City of Spokane has experienced very satisfactory results in using the 5 year design frequency for the approximately 57 miles of storm sewers now in operation within the City.

A 25 year design frequency was selected for sizing combined relief sewers. The use of a less frequent, more intense rainfall event for relief sewers than used for storm sewers is a standard design practice when sizing combined sewers because of possible basement flooding and consequent greater damage which may occur with overloaded combined sewers.

In comparing the design frequencies for storm sewers and relief sewers, the following can be said: The 5 year frequency storm sewer design and the 25 year frequency relief sewer design allow for zero percent and 4 percent chance of basement flooding in any one year due to storm water backup, respectively.

In order to provide a variety of data from which to make decisions, designs for 5, 10, 25, and 50-year frequency protection are presented in the report for storage basins and for satellite treatment facilities. The City of Spokane feels that the 25 year frequency is the most reasonable compromise between a fairly high degree of protection and the least possible cost.

When comparing the different frequencies studied for storage basins or satellite treatment facilities versus the 5 year design frequency for storm sewers, the following can be

stated: The 5, 10, 25, and 50-year design frequencies for storage basins or satellite treatment facilities would allow for a 20, 10, 4 and 2 percent chance, respectively, of having raw sanitary sewage discharged to the Spokane River in any one year. The 5 year design frequency for storm sewers will allow for zero percent chance of discharge of raw sanitary sewage to the Spokane River.

TABLE 15

MAXIMUM RECORDED PRECIPITATION
SPOKANE, WASHINGTON

1900 – May, 1977

DURATION	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1 hour	0.19[1] 1953[2]	0.20 1963	0.23 1940	0.30 1937	0.77 1946	1.02 1941	0.65 1975	0.93 1943	0.55 1973	0.37 1934	0.36 1949	0.25 1941
2 hour	0.32 1953 1969	0.28 1940 1964 1965 1974	0.34 1940	0.40 1972	0.89 1907	1.09 1941	0.75 1975	0.98 1943	0.78 1973	0.60 1934	0.43 1958	0.38 1941
3 hour	0.38 1953 1954	0.34 1958 1963 1965	0.34 1940	0.51 1946	0.89 1907	1.09 1941	0.75 1975	0.98 1943	0.79 1973	0.60 1934	0.50 1958	0.44 1941
					1881 – MAY	1977						
24 hour	1.53 1882	1.13 1940	0.91 1950	1.04 1882	1.72 1925	2.22 1888	1.20 1940	1.65 1923	1.67 1927	1.43 1899	1.50 1885	1.60 1951

[1] Amount in inches

[2] Year

MONETARY COST ANALYSIS OF ALTERNATES

General

Figures 3 and 4, construction cost curves, and costs per acre for Relief and Storm Sewers shown on Page 67 were developed from detailed cost analysis done on three typical drainage basins. These costs analysis were part of this study and were reported in draft reports entitled, "Facilities Planning Report for Project Area 1--Erie Street Drainage Basin" and "Facilities Planning Report for Project Area 2--Assembly-Shadle Basin and North Central Basin". All costs are based on anticipated June 1978 prices.

In the following cost analysis, the wet weather overflow points are arranged in seven groupings. The groupings were selected to allow for equal comparisons between each alternate for different parts of the City. The groupings are as follows:

OVERFLOW GROUP	OVERFLOW POINTS SERVED
1	042, 041
2	040, 039, 038, 034, 033
3	037, 031, 030
4	026, 025, 024, 022B, 020, 019, 017, 016
5	027, 023, 015, 014
6	012, 010, 007
7	006, 003, 002

Construction Costs for Alternate 1 (Storage Basins)

Figure 3 shows the estimated construction costs for storage basins versus storage volume capacity. Exhibits 22 through 33 present construction costs for Storage Plans A, B, and C with storage basins sized for 5, 10, 25, and 50 year

frequency storms. Exhibit 34 summarizes the costs presented in Exhibits 22 through 33.

Exhibit 34 shows that costs are about the same for Storage Plans A, B, and C, with Plan B being slightly less costly than Plans A or C. Considering other than monetary cost factors, Storage Plan B is the most reasonable choice for the City of Spokane. Therefore, for the remainder of this report, only Storage Plan B will be considered under the storage alternate.

This report has presented storage basin costs for 5, 10, 25, and 50 year frequency design storms. Which frequency to actually design for is a difficult decision. From a statistics point of view, there is a 20, 10, 4 and 2 percent chance in any one year of a storage basin overflowing into the Spokane River for storage basins designed for the 5, 10, 25, and 50 year storms, respectively. In considering the interest of downstream property owners to clean up the Spokane River and keep it clean, plus the ever increasing threats of law suits if sanitary sewage is dumped into the Spokane River, it would seem prudent to select a design storm which provides for a high degree of protection. The 25 year storm was selected for analysis in this report because it offers the best balance between a high degree of protection and project costs.

Construction Costs for Alternate 2 (Satellite Treatment)

Figure 4 shows the estimated construction costs of satellite treatment facilities per treatment plant flow capacity. Exhibits 35 through 46 present construction costs for treatment facilities for Plans A, B, and C. As with the storage alternate,

the treatment plans were sized for 5, 10, 25, and 50 year frequency storms. Exhibit 47 summarizes the costs presented in Exhibits 35 through 46.

For the same reasons as listed above for the storage alternate, Satellite Treatment Plan B will be the only treatment plan considered in the remainder of this report. Also, as with the storage alternate, the 25 year frequency design storm will be used.

FIGURE 3

STORAGE BASINS
CONSTRUCTION COSTS VERSUS CAPACITY

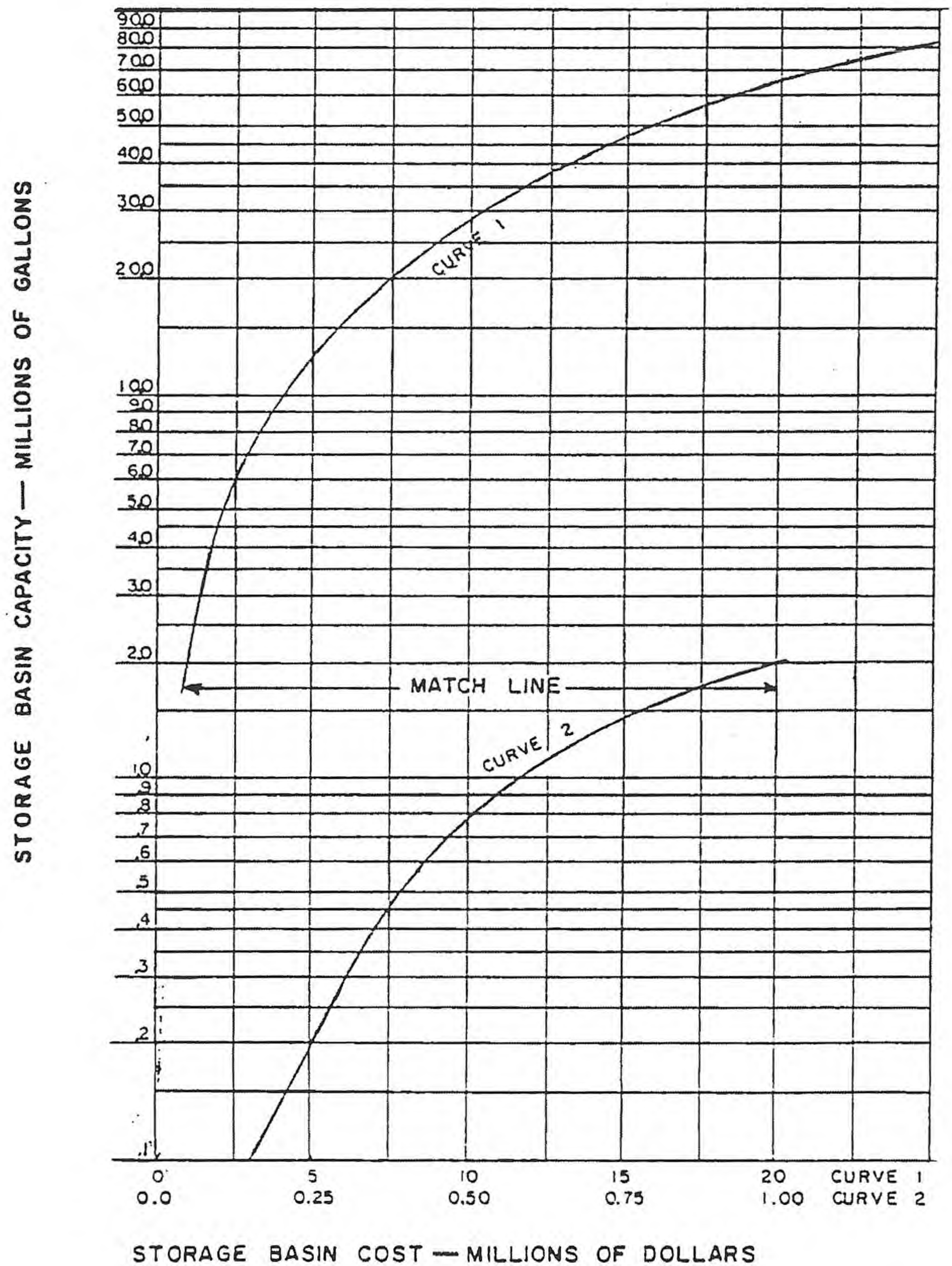
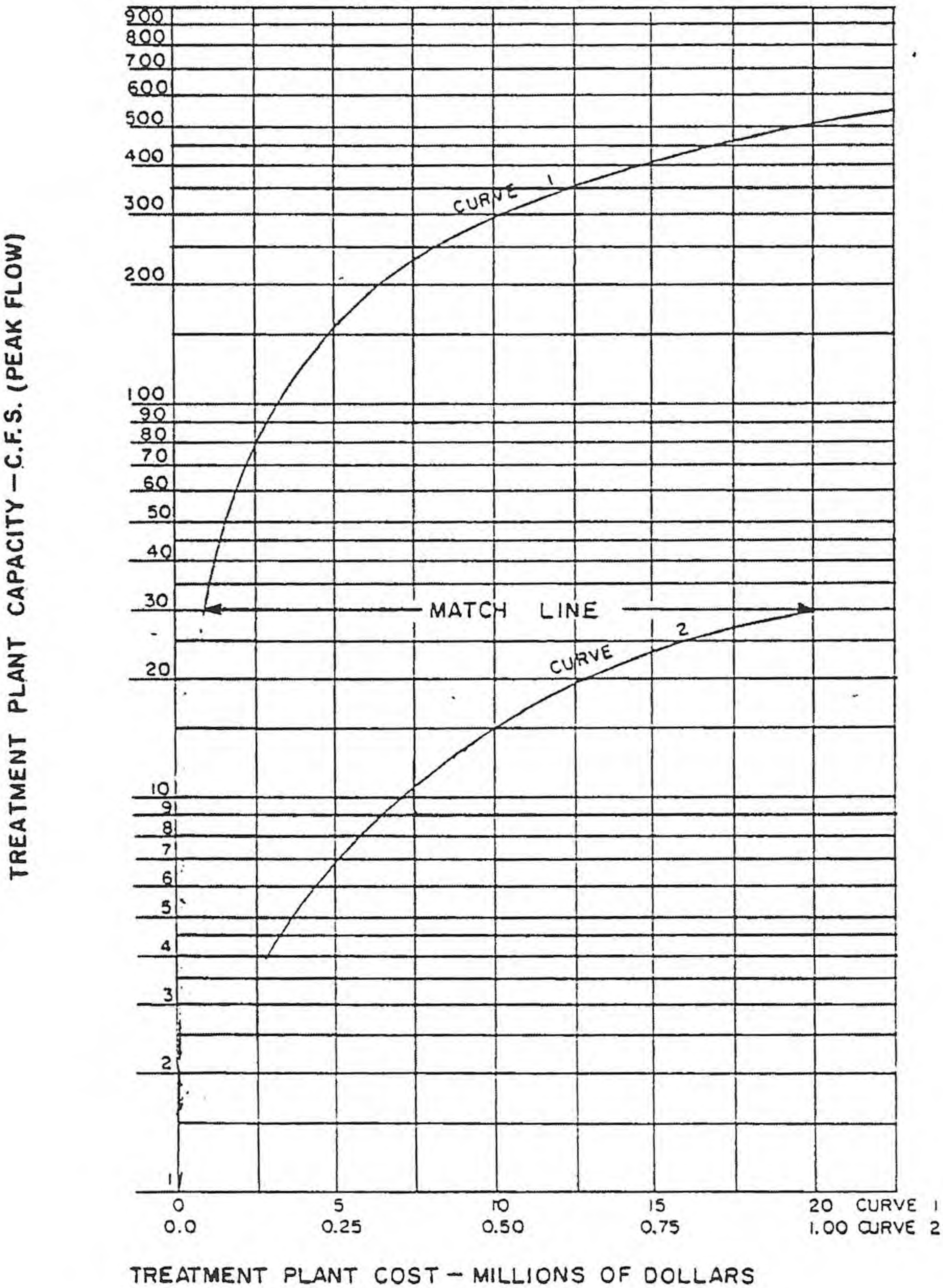


FIGURE 4

SATELLITE TREATMENT PLANTS
CONSTRUCTION COSTS VERSUS CAPACITY



Construction Costs For Alternate 3 (Storm Sewers)

Exhibit 48 shows the construction costs for storm sewers for each overflow point served and for each grouping of overflow points. Storm sewer costs were computed using the following costs per acre:

Basin Areas with No Solid Rock Excavation	$ 3,800 per acre
Basin Areas with Partial Solid Rock Excavation	4,700 per acre
Central Business District Area	12,000 per acre

Construction Costs For Relief Sewers

Exhibit 49 shows the construction costs for relief sewers for each overflow point served and for each grouping of overflow points. Relief sewer costs were computed using the following costs per acre:

Basin Areas with No Solid Rock Excavation	$ 1,500 per acre
Basin Areas with Partial Solid Rock Excavation	2,500 per acre

Annual Operation and Maintenance Costs

Annual operation and maintenance costs were computed using the following cost relationships:

Storm or Relief Sewers	$ 700 per mile of sewer
Storage Basins	$1,600 per million gals of storage capacity
Satellite Treatment Plants	$ 250 per cfs of flow capacity

Other Cost Items

Other cost items included in the monetary cost analysis are as follows:

Land Costs -	Sewer construction will not have any land costs since construction would take place in existing City right of way or easements. Land costs for storage or treatment facilities was based on a rate of $65,000 per acre and are included within construction cost curves.

Ineligible Costs -	Land costs are ineligible and will have to be segregated if either the storage or treatment alternate is selected for construction. There are very few separate building storm connection leaders within the City so the ineligible cost of reconnecting these leaders is negligible for this study. Alternates with ineligible costs place an added cost burden on the City.
Design Engineering and Field Inspection Costs -	20% of construction costs
Legal & Administration Costs -	2% of construction costs
Planning Period -	20 years
Salvage Value -	Straight line depreciation
Service Life -	50 years for sewers and structural items. 20 years for pavement and equipment. Land has permanent life.

Cost Summary

Table 16 summarizes costs between the three alternates not including relief sewer costs. Therefore, this table indicates which alternate has the least annual monetary costs for correcting wet weather overflow problems only. Table 17 summarizes costs including relief sewer costs which means that this table indicates which alternate has the least annual monetary costs for correcting wet weather overflows plus sewer overloading and backup problems. As stated previously in the "Explanation of Design/Rainfall Frequency Data", section of this report, storage basins, satellites treatment facilities, and relief sewer costs in Tables 16 and 17 are based on 25 year design frequencies and storm sewer costs are based on 5 year frequencies. Also stated previously, the costs

for both the storage and treatment alternates are based on Plan B. Exhibit 50 shows the economic analysis used to arrive at the annual costs presented in Tables 16 and 17.

TABLE 16

COST SUMMARY NOT INCLUDING RELIEF SEWER COSTS

OVERFLOW GROUP	OVERFLOW POINTS SERVED	CONSTRUCTION COSTS ANNUAL OPERATION & MAINTENANCE COSTS TOTAL ANNUAL COSTS		
		Alternate 1 Storage	Alternate 2 Satellite Treatment	Alternate 3 Storm Sewers
1.	042,041	$ 1,100,000 2,600 105,813	$ 975,000 7,200 108,788	$ 610,000 1,700 61,789*
2.	040,039 038,034 033,032	13,675,000 61,400 1,451,839*	13,300,000 92,200 1,574,251	14,720,000 36,000 1,607,116
3.	037,031 030	4,300,000 14,700 419,087	3,100,000 23,200 346,199	2,930,000 7,400 296,026*
4.	026,025 024,022B 020,019 017,016	17,075,000 72,500 1,859,419*	18,225,000 124,600 2,227,420	16,900,000 29,300 1,860,900
5.	027,023 015,014	2,525,000 7,700 245,036	2,525,000 17,700 280,788	1,730,000 4,600 175,017*
6.	012,010 007	22,425,000 113,400 2,556,072	18,125,000 122,000 2,213,282*	20,890,000 57,700 2,397,345
7.	006,003 002	7,950,000 30,600 802,354	6,550,000 49,300 744,697	6,270,000 17,300 645,255*
TOTALS		$69,050,000 302,900 7,439,620	$62,800,000 436,200 7,495,425	$64,050,000 154,000 7,043,448*

*Alternate that has the least annual monetary cost for correcting wet weather overflow problems only.

TABLE 17

COST SUMMARY INCLUDING RELIEF SEWER COSTS

OVERFLOW GROUP	OVERFLOW POINTS	CONSTRUCTION COSTS ANNUAL OPERATION & MAINTENANCE COSTS TOTAL ANNUAL COSTS		
		Alternate 1 Storage & Relief Sewers	Alternate 2 Satellite Treatment & Relief Sewers	Alternate 3 Storm Sewers
1.	042,041	$ 1,350,000 3,000 129,875	$ 1,225,000 7,600 132,852	$ 610,000 1,700 61,789*
2.	040,039 038,034 033,032	21,255,000 70,500 2,368,601	20,880,000 101,300 2,486,175	14,720,000 36,000 1,607,116*
3.	037,031 030	5,780,000 16,600 568,669	4,580,000 25,100 489,680	2,930,000 7,400 296,026*
4.	026,025 024,022B 020,019 017,016	24,365,000 79,900 2,769,838	25,515,000 132,000 3,157,466	16,900,000 29,300 1,860,900*
5.	027,023 015,014	3,305,000 8,900 320,059	3,305,000 18,900 355,811	1,730,000 4,600 175,017*
6.	012,010 007	31,135,000 127,400 3,738,550	26,835,000 136,000 3,334,519	20,890,000 57,700 2,397,345*
7.	006,003 002	10,780,000 35,100 1,107,910	9,380,000 53,800 1,044,235	6,270,000 17,300 645,255*
TOTALS		$97,970,000 341,400 11,003,502	$91,720,000 474,700 11,000,738	$64,050,000 154,000 7,043,448*

*Alternate that has the least annual monetary cost for correcting wet weather overflow problems plus sewer overloading and backup problems.

OTHER COST CONSIDERATIONS

Future Sanitary Sewer System Expansion

An important cost consideration is the cost of expanding future sanitary sewer service to unsewered areas both within the City and in nearby County areas. Under the three alternates studied, capacity in the existing trunk and interceptor sewer system and the sewage treatment plant is reserved for existing sanitary flows. In addition, a limited amount of capacity is also reserved for expanding sanitary sewer service to such areas as Beacon Hill, Glenrose, Moran Prairie, Thorpe Road, Indian Trail, Cozza Calkins etc. All remaining capacity would be used for storm flow with excess storm flow being handled by one of the three alternates (Storage Basins, Satellite Treatment Plants, or Storm Sewers).

It would be possible to expand Alternate 2 (Satellite Treatment) to treat all storm overflows at the satellite treatment sites. This would mean that except for sludge from the treatment process there would not be any storm flow placed in the interceptor sewer system allowing for the saved capacity in the interceptor and main treatment plant to be used for future expansion of sanitary sewer service. The same situation would be true for Alternate 3 (Storm Sewers) since additional storm sewers could be built within the City so that all storm flow is removed from the interceptor sewer and main sewage treatment plant. In fact, under this alternate, storm flow would be removed from the entire existing combined sewer system which would allow for even more flexibility in expanding sanitary sewer service. Under Alternate 1 (Storage Basins), available interceptor and main sewage

treatment plant capacity would always be required for storm flow, thus restricting expansion of sanitary sewer service.

One example of how valuable excess capacity in the interceptor sewer system and sewage treatment plant could be is illustrated by the fact that, if all storm flow from areas contributing to just Overflow Points 032, 033, 034, and 035, were removed from the interceptor, enough flow capacity would be made available to transport all sanitary sewage generated in the entire Spokane Valley area to the City's sewage treatment plant. The new sewage treatment plant will have capacity to handle much of this flow, and the plant is designed for future expansion. The additional costs required for eliminating all storm flow to the interceptor from the areas contributing to the above overflow points is $2,500,000 for the Satellite Treatment Alternate and $3,000,000 for the Storm Sewers Alternate. Costs for eliminating all storm flow to the interceptor City wide is 6,500,000 for the Satellite Treatment Alternate and $8,000,000 for the Storm Sewer Alternate.

Future Costs of Operation and Maintenance

Future costs of operation and maintenance are important cost considerations since these costs will continually be affected by inflation. Inflation was not considered in the "Monetary Cost Analysis of Alternates" section of this report, but it should be pointed out that the alternate with the lowest operation and maintenance costs at present will look even more attractive in the future if inflation continues to be a factor in the nation's economy. The operation and maintenance costs for the Storm Sewer Alternate are considerably lower than for either

of the other alternates studied. The Storage Basins Alternate has the next lowest operation and maintenance costs with the Satellite Treatment Facilities Alternate having the highest.

Future Energy Consumption

Future energy requirements are an important consideration when comparing each of the alternates. Not only is the future cost of energy important, but also its availability. The Storm Sewers Alternate will require by far the least amount of energy followed by the Storage Basins Alternate and the Satellite Treatment Facilities Alternate, respectively.

Future Chemicals Consumption

Future consumption of chemicals is an important consideration. The Storm Sewers Alternate will not require any chemicals whereas both of the other alternates will require chemicals during treatment processes.

Future Street Maintenance

The Storm Sewers Alternate will require more widespread disturbance of street surfacing than will either of the Storage or Treatment Alternates. Patched streets sometimes require additional maintenance and therefore, the Storm Sewers Alternate could require increased street maintenance costs.

The City of Spokane presently has a continuing street resurfacing program. Consequently, this possible increased street maintenance costs would tend to disappear in time as each patched street was resurfaced.

Future Infiltration/Inflow

Infiltration/Inflow occurs in certain portions of the City's sewer system. Some infiltration/inflow, other than from

catch basins, is generated from inflow from water cooled air conditioning equipment, inflow from illegal floor and roof drains, and infiltration into the sewer system from high ground water areas. This Infiltration/Inflow, although relatively insignificant when compared to peak storm flows, deprives the sewer system and sewage treatment plant of capacity that could be used for sanitary flow. The Storm Sewer Alternate is the only alternate that could increase interceptor and treatment plant capacity by removing much of this flow from the sanitary sewers and placing it in a storm sewer system.

Reliability

Reliability is important for any system dealing with storm water runoff. The Storm Sewers Alternate is the most "fail-safe" of all the alternates considered. The Storage Basins Alternate would be the next most reliable system, and the Satellite Treatment Facilities Alternate would be the least reliable.

ENVIRONMENTAL COMPARISON OF ALTERNATES

General

The effects each alternate would have on the environment can be divided into two categories; construction and operation. In the following paragraphs a comparison of the alternates will be presented with respect to both the adverse and the favorable environmental effects during construction and operation phases.

Construction Phases

As with any capital improvement of this magnitude, the construction phase for any of the alternates would cause unavoidable temporary disruptions to normal community activity. Obstructions, noise, dust, and public safety are the most signi-

ficant environmental items that would be effected by implementing any one of the alternates.

Temporary obstructions to the free movement of the public through each construction site will occur for each alternate in terms of public transportation, private automobile, and pedestrian traffic. This would be more true for the Storm Sewers Alternate than for either of the Storage or Treatment Alternates, since for the Storm Sewer Alternate, work would be spread out over a larger area of the City. Construction activity for either of the Storage or Treatment Alternates would be more confined and not pose as serious an obstruction problem. If relief sewers were to be built as part of either the Storage or Treatment Alternate, the same type of obstruction problems as posed for the Storm Sewers Alternate would be encountered.

Increases in noise levels may be noticed near the construction activity for each alternate. With either of the Storage or Treatment Alternates, a large amount of the construction work would center around the storage basin or treatment facility sites causing, in the immediate area, the usual amount of noise associated with large construction projects. Noise connected with storm sewer (or relief sewer) work would be spread out over a larger area but also would be of shorter duration at any one location than for storage basin or treatment facility construction.

An increase in dust levels is a potential problem at each construction site. As with noise, dust problems may be more concentrated at the storage basin or treatment facility sites and less concentrated but more sidespread for storm sewer (or relief

sewer) construction work. A proper dust control program should eliminate this from becoming a major environmental issue.

Public safety would probably be most effected by the Storm Sewer Alternate since with this alternate construction activity would take place over a wider area and thus effect more people. However, both the Storage or Treatment Alternates would also effect public safety, and regardless of which alternate is implemented, proper safety practices would have to be followed to protect the public.

Operation Phases

Other sections of this report have presented environmental issues related to operation phases such as; river quality with respect to "Class A" standards, basement flooding and associated health hazards, energy considerations, aesthetics, infiltration/inflow, capital and operating costs, and the need for possible future sewer system expansion. A review of some of these and other environmental items is presented as follows:

1. Air quality - Air quality is not considered to be a major problem with any of the alternates studied. The only potential problem is possible odor problems with Alternate 1 (Storage) or Alternate 2 (Satellite Treatment). Proper operation and maintenance should avoid this type of problem.

2. Aesthetics - In most cases aesthetics would not be a problem with any of the alternates discussed in this report since most construction is proposed to be below natural ground levels and would not be visible to the public upon completion. Areas of construction would have to be restored to original conditions and in some cases additional landscaping would be in order. In some locations, very large storage basins or treatment facilities would be difficult to completely conceal from public view and care would have to be taken to make sure these structures would be aesthetically

pleasing. Storm sewers would connect to existing overflow outfalls to the river, and most of these outfalls are concealed from public view.

3. Social Factors (Community growth pattern and land use) - The projects being considered in this report will not have a significant effect on social factors other than those items discussed in the "Other Cost Considerations" section of this report.

4. Noise - The operation of satellite treatment facilities, pumping facilities, or the sound of rushing water are the only possible noises that could be associated with the projects under study. Due to the proposed underground nature of construction, it is doubtful that any of these noises would be audible to the general public.

5. Energy - The amount of energy used by a proposed project is a very important consideration. This item is discussed in the "Other Cost Considerations" section of this report. Essentially the Storm Sewer Alternate requires no energy to operate. The Storage Basin Alternate requires energy for central monitoring, gate controls, and, for some basins, outflow pumps. The Satellite Treatment Alternate requires energy to run the entire treatment system. Energy would be required only during storm periods which would tend to create peak type energy loads rather than uniform loads. All alternates would have certain amounts of energy consumption during maintenance operations.

6. Ground water - The only real significance ground water has in this study is as it relates to infiltration. This is discussed in the "Infiltration and Inflow Information" section of this report.

7. The following environmental items were reviewed and considered to be not applicable to the projects being considered: wetlands, unique agricultural lands, cultural lands, soil conservation, plant communities, and animal communities.

8. Surface Water - This item is really the meat of this entire report as it relates to storm runoff into the Spokane River and its effect on the water quality of the river and on downstream beneficial uses. This item is discussed in preceding sections of this report and will be discussed in more detail in the following sections.

The primary environmental issue remaining to be discussed is the effects each alternate would have on the water quality of the Spokane River during operation phases and how these effects relate to the river's "Class A" status. As discussed in the "Summary of Receiving Water Quality" section of this report, the primary "Class A" parameter of concern is coliform count. As indicated in Table 18, all of the alternates studied will make very substantial reductions in the total annual number of coliform bacteria that can enter the river. However, an exact accounting of how each alternate would effect coliform bacterial concentrations in the river can not be made at this time. Instead, the following general statements concerning this matter can be made:

> The Storm Sewer Alternate would completely eliminate the possibility of sanitary sewage entering the Spokane River. With this alternate storm water discharges to the Spokane River would occur on a frequent basis with mostly low coliform counts. Even the low coliform counts in the storm water could periodically cause the water quality of the river to slightly exceed "Class A" standards for short periods of time depending on flow conditions in the river and the amount of storm water discharged. First flush conditions are most likely to cause coliform counts to exceed "Class A" standards. This condition can be minimized by good surface housekeeping. A good street sweeping operation is one of the most effective methods of reducing storm sewer pollution loads from first flush. The City of Spokane has a continuous and effective street cleaning program during the spring, summer and fall months when the river is being used for water contact sport activities. The City's cleaning equipment includes the use of vacuum cleaners which can clean streets with a minimum use of water, and thus a minimum amount of pollutants are washed into catch basins during street cleaning operations. In addition, the catch basins in the City of Spokane are designed to trap heavy sediments and floatables. The City's Sewer Maintenance Division has a continuous catch basin cleaning program in order to keep all catch basins functioning properly. Under the Storm Sewer Alternate, all sanitary sewage would receive secondary treatment plus phosphorus removal.

Both the Storage or Treatment Alternates would greatly reduce the chance of sanitary sewage being discharged to the Spokane River. With either of these alternates, combined storm and sanitary sewer overflows would be on a very infrequent basis. Coliform counts in overflows would be high and could cause the water quality of the river to greatly exceed "Class A" standards depending on flow conditions in the river and the amount of combined overflows. Under either of these alternates, combined flows approaching about half the capacity of the interceptor sewer would receive secondary treatment plus phosphorus removal. Flows in excess of this would receive primary treatment, and flows in excess of storage basin or satellite treatment plant capacity would be discharged directly to the river.

In addition to showing coliform bacteria count, Table 18 presents estimates of annual emissions caused by storm runoff to the Spokane River for BOD, suspended solids, volatile suspended solids, and phosphorus. As stated previously in this report, BOD and phosphorus loadings caused by storm runoff are not considered to have a significant impact on "Class A" parameters, but any reduction in these loadings would be another step forward in removing pollutants from the river which can contribute to dissolved oxygen or other problems.

TABLE 18

COMPARISON OF POLLUTION FACTORS
IN SPOKANE RIVER FOR EACH ALTERNATE STUDIED

POLLUTANT TYPE	PERCENT REDUCTION FROM EXISTING CONDITIONS			TOTAL ANNUAL EMISSIONS TO THE SPOKANE RIVER CAUSED BY STORM RUNOFF ONLY-EXISTING CONDITIONS
	ALT. 1 Storage Basins	ALT. 2 Satellite Treatment Facilities	ALT. 3 Storm Sewers	
Fecal Coliform Bacterial	99+	99+	99+	1.3 x 10^{17} Organisms
BOD	40	36	55	210 Tons
Suspended Solids	45	43	4	582 Tons
Volatile Suspended Solids				241
Total Phosphorus	23	0	58	6.0 Tons

Note: Existing conditions assumes new sewage treatment plant in operation providing secondary treatment and phosphorus removal plus a minimum of primary treatment for treatment plant by-passes. Reduction values based on making optimum use of interceptor sewer capacity for all three alternates. The above figures are based on loadings from the entire city.

As improvements are made in the water quality of the Spokane River, the recreational uses of the river will be enhanced. Presently, the river is used for water sports such as fishing, boating, swimming, and water skiing. The shore areas provide camping, beaches, and other water related activities. However, the fact that raw sewage can be discharged into the river during storm runoff periods tends to discourage many people from using the river to its full potential. In addition, property owners along the river are becoming more and more vocal concerning the water quality of the river. In short, they do not want any sanitary sewage in the Spokane River. For these reasons it is important that projects be implemented so that sanitary sewage can be removed from the Spokane River. In addition, the water quality of the river should be continually monitored so that a record can be kept of the improvements in water quality as overflow abatement projects are completed throughout the city.

Additional information can be found in the "Environmental Assessment",[10] prepared for the construction of the City's new sewage treatment plant. Also a "SEPA Guidelines Environmental Check List Form" has been completed and is included in this report as part of Exhibit 51.

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[10] Bovay Engineers Inc., Consulting Engineers, Environmental Assessment, June 1973.

IMPLEMENTATION OF ALTERNATES

Regardless of which alternate is selected, the implementation procedures would be similar. Implementation steps consist of site and right-of-way acquisition, field surveys, design, construction, and operation.

Upon acceptance of the Facilities Plan, site and right-of-way acquisition work would begin. Construction of storm sewers (or relief sewers) would require very little site and right-of-way acquisition since almost all of this work would be done in existing street right-of-way. The construction of storage basins or treatment facilities would require acquisition of property although some of this work would also take place within existing street right-of-way.

In addition to site and right-of-way acquisition, field survey work would also start immediately. Field work for the Storm Sewers Alternate would be greater than for the Storage or Treatment Alternates (including relief sewers) since the Storm Sewers Alternate consists of projects covering a larger more widespread area. The amount of field work required will be lessened by the fact that a great deal of the field information that is needed is already on file in City Hall.

After the completion of field surveys, design work would begin. The design work for storm sewers (or relief sewers) would be straight forward and would progress rapidly. Design

work for storage basins or treatment facilities would be more complex and time consuming.

Following the completion of design work, construction would begin. Storm sewers (or relief sewers) would require construction activity of a fairly simple nature spread out over a wide area. Several sewer construction projects could be going on at once within the City. The major task involved would be to coordinate construction activity to provide for the least amount of conflicts between each project and the least inconvenience to the public. Storage or treatment facilities would require construction activity of a more complex nature in a more concentrated area.

After construction, the completed project would have to be put into operation. Except for normal operation and maintenance there is really no extra effort required to place the Storm Sewers Alternate into operation after construction is completed. The Storage Basin Alternate would require some experimentation during the first year of operation to decide how best to regulate the storage basins during storm runoff periods. The Satellite Treatment Facilities Alternate would also require some preliminary experimentation to determine the best way to operate the treatment facilities.

PLAN SELECTION

VIEWS OF PUBLIC AND CONCERNED INTERESTS

Many attempts have been made by the City to inform and to receive comments from the public and other concerned interests. These have taken the form of informational meetings or hearings and written correspondance from the State and District A-95 Clearinghouses, from private citizens, and from other government agencies.

The public has had several opportunitities to become informed of this project. Public involvement meetings have been held at various locations on February 18th and 26th, March 4th and 30th, and May 10th, 11th and 18th. A formal public hearing was held on April 12, 1977 in the City Council Chambers. Each meeting was advertised several times in each of the City's main newspapers -- The Spokesman Review and The Spokane Daily Chronicle. This study has also received a good deal of public exposure from television news releases, articles in the local newspapers, and notices posted on telephone poles in various areas of the City. In addition, about 100 concerned organizations, government officials and agencies, and individuals were sent informational packets describing the nature of the project and giving the time and location of the public meetings to be held.

The audiences at these meetings and the hearing were given the opportunity for input to this study. Comments were solicitated in the form of oral statements and questionaires. The questionaire asked each person to rank the alternates according

to their preference and add any other comments. Attendance at the meetings averaged about 14 persons. Many of them responded to the questionaire, with most favoring the storm sewer alternate.

The City has made a sincere effort to encourage citizens to come in to City Hall to review project material. Consequently additional public input has been obtained from individuals who have either phoned or come to City Hall to offer their comments and ask questions. The most common questions asked are:

1. What are the project costs and who will pay these costs?
2. Which streets will be torn up for construction?
3. Will sewer backup problems be solved?
4. When will all this work be done?

See the Appendixes for Affidavit of Notice of Public Hearing, Transcripts of Public Hearing and Meetings, Clearinghouse Comments, Letters of Testimony, Overflow Studies Mailing List, Public Opinion Surveys, and Alternate Plan Submittal.

TRADE OFF EVALUATION AND RANKING OF PROPOSALS

Table 19 compares total monetary, resource, environmental and social costs of each alternate, including the "No Action" alternate. The intent of the table is to rank each alternate by scoring them, on pertinent cost items.

Scores, for each cost item, are equal to "weight" times "rate". Since some items are more important than others, we have "weighted" them accordingly, with "3" indicating the most, "2" moderate, and "1" the lesser important items. The "rating" criteria gives a value of "1" to "4" for each alternate on each item. The most desirable alternate would be given a value of "1" and the least desirable alternate given a value of "4". The total of all rates on any one item must equal "10". For example, if two alternates are equally desirable and cannot be rated "1" and "2", they will both be rated "1.5", with the third most desirable alternate given a rate of "3".

In summary, each alternate is given a score, for each cost item, equal to "weight" times "rate". Scores are then totaled for each alternate and the least total score indicates the alternate that fulfills the projects' purpose, with the least monetary and social costs, the best use of resources and the most beneficial impact on the environment.

TABLE 19

COST ITEM WEIGHT x RATE = SCORE		ALT. 1 RELIEF & STORAGE		ALT. 2 RELIEF & TREATMENT		ALT. 3 STORM SEWERS		NO ACTION	
DESCRIPTION	WEIGHT	RATE	SCORE	RATE	SCORE	RATE	SCORE	RATE	SCORE
Least Annual Number of Coliform Bacteria to River	3	2	6	2	6	2	6	4	12
Most Completely Eliminates Sanitary Sewage Discharges to River	3	2	6	3	9	1	3	4	12
Least Annual BOD Load to River	2	2	4	3	6	1	2	4	8
Least Annual Total Phosphorus Load to River	2	2	4	3.5	7	1	2	3.5	7
Least Annual Suspended Solids Load to River	2	1	2	2	4	3	6	4	8
Least Effect on Turbidity Level in River	2	2	4	1	2	3	6	4	8
Least Annual Costs	3	4	12	3	9	2	6	1	3

TABLE 19

COST ITEM WEIGHT x RATE = SCORE		ALT. 1 RELIEF & STORAGE		ALT. 2 RELIEF & TREATMENT		ALT. 3 STORM SEWERS		NO ACTION	
DESCRIPTION	WEIGHT	RATE	SCORE	RATE	SCORE	RATE	SCORE	RATE	SCORE
Least Total Construction Costs	1	4	4	3	3	2	2	1	1
Least Total Capital Costs	1	4	4	3	3	2	2	1	1
Least Operation and Maintenance Costs	1	3	3	4	4	2	2	1	1
Least Impact During Construction	2	3	6	2	4	4	8	1	2
Requires the Least Amount of R/W Acquisition	2	4	8	3	6	1.5	3	1.5	3
Most Completely Eliminates Sewer Backups	3	2.5	7.5	2.5	7.5	1	3	4	12
Operationally Most Reliable	2	2	4	3	6	1	2	4	8

TABLE 19

COST ITEM WEIGHT x RATE = SCORE		ALT. 1 RELIEF & STORAGE		ALT. 2 RELIEF & TREATMENT		ALT. 3 STORM SEWERS		NO ACTION	
DESCRIPTION	WEIGHT	RATE	SCORE	RATE	SCORE	RATE	SCORE	RATE	SCORE
Expands Future Sanitary Capacity of Trunk and Interceptor System	2	3	6	2	4	1	2	4	8
Expands Future Sanitary Capacity of Sewage Treatment Plant	2	3	6	2	4	1	2	4	8
Provides a Way to Eliminate Certain Types of Inflow	2	3	6	3	6	1	2	3	6
Least Amount of Energy Required During Project Life	1	4	4	3	3	2	2	1	1
Least Amount of Chemicals used During Project Life	1	4	4	3	3	1.5	1.5	1.5	1.5
Preference of Citizens Who Attended Public Meetings	3	2.5	7.5	2.5	7.5	1	3	4	12
TOTAL SCORE			108		104		65.5		122.5
COMPOSITE OVERALL RANKING			3rd CHOICE		2nd CHOICE		1st CHOICE		4th CHOICE

SELECTED PLAN AND REASONS FOR SELECTION

Alternate 3 (Storm Sewers) is the alternate recommended by the City of Spokane for implementation. All information presented in this report shows that Atlernate 3 not only provides for the lowest short term and long term monetary costs to society but also the lowest total resource, environmental, and social costs as well. This alternate conforms to the City's Comprehensive Plan and provides for expansion of sanitary sewer service to the Spokane Valley as well as to other City and County areas when the need arises.

THE SELECTED PLAN

DESCRIPTION AND MAPS

Alternate 3 (Storm Sewers) is described in detail throughout the "Comparing of Alternatives" section of this report. The layout and sizes of the proposed storm sewer systems are shown in "Exhibits 15-19".

OPERATION AND MAINTENANCE REQUIREMENTS

The operation and maintenance of the proposed storm sewer system will be handled by the Sewer Maintenance Division of the City of Spokane. This department presently handles the operation and maintenance on the over 600 miles of sewers and 12,000 catch basins already installed within the City.

MONETARY COST ESTIMATES

The costs estimates for Alternate 3 (Storm Sewers) are shown in the "Monetary Cost Analysis of Alternates" section of this report. The total costs are summarized below:

Total Construction Costs	$64,050,000
Total Capital Costs	87,000,000
Yearly Operation and Maintenance Costs	154,000

SUMMARY OF ENVIRONMENTAL EFFECTS

Information concerning environmental effects is presented in the "Environmental Comparison of Alternates" section of this report. Most of the environmental considerations favored Alternate 3 (Storm Sewers).

SUMMARY OF PUBLIC PARTICIPATION

Seven public involvement meetings and one formal public hearing have been held during the course of this study. Most citizens participating in the meetings expressed a preference for Alternate 3 (Storm Sewers). Refer to the "Views of Public and Concerned Interests" section of this report for more information on public participation.

IMPLEMENTATION

It is anticipated that construction money will not be available immediately for eliminating all overflow points. Therefore, overflows will have to be eliminated on a priority basis as money becomes available. Table 20 shows the priority ratings for eliminating overflow conditions. The ratings are based upon eliminating worst overflow conditions first.

TABLE 20

PRIORITY RATINGS FOR OVERFLOW CORRECTION

Priority No.	Overflow No.	Overflow Location	Percent of Total Wet Weather Overflow Volume	Construction Costs
1.	034 032 035	Front Avenue Erie Street + Mallon Avenue	Dry Weather Overflows	$ 540,000
2.	1 010	Meenach Drive	71	18,990,000
3.	2 003	Hollywood	10	3,780,000
4.	037	3 3 Sharp Avenue	2-3	440,000
5.	026	Lincoln @ Trent	2-3	6,710,000
6.	033	Erie Street +	2-3	6,830,000
7.	015	Ohio Avenue	1-2	490,000
8.	012	Nora @ Pettet	1-2	1,420,000
9.	030	Washington Street (N.C.)	1-2	2,370,000
10.	024	Cedar @ Riverside	1-2	7,030,000
11.	034	Front Avenue +	1-2	7,310,000
12.	036	Desmet Avenue	< 1	5,000
13.	025	Cedar @ Main	< 1	70,000
14.	031	Astor @ Desmet (N.C.)	< 1	120,000

1:30

TABLE 20 (Cont.)

Priority No.	Overflow No.	Overflow Location	Percent of Total Wet Weather Overflow Volume	Construction Costs
15.	022B	Elm Street	<1	$ 120,000
16.	017	West Grove Syphon	<1 GOVT M	140,000
17.	039	Altamont Street	<1	170,000
18.	019	Seventh Avenue	<1	170,000
19.	040	Regal Street	<1	190,000
20.	038	Magnolia Street	<1	220,000
21.	042	Surro Drive	<1	240,000
22.	014	Sherwood @ Summit	<1	260,000
23.	002	Hartley Street	<1	300,000
24.	027	Monroe Street	<1	310,000
25.	041	Rebecca Street	<1	370,000
26.	007	Columbia Circle	<1	480,000
27.	023	Cedar @ Ide	<1	670,000
28.	016	High Bridge Park	<1	870,000
29.	020	South Manito	<1	1,790,000
30.	006	Garland Avenue	<1	2,190,000
	035	Mallon Avenue +	<1	Eliminated with Priority No. 1
	032A&B	Erie Street +	<1	Eliminated with Priority No. 1
	029	Howard Street (N.C.)	<1	Eliminated with Priority No. 9
			TOTAL	$64,595,000*

*Includes costs for dry weather overflow correction (Priority Item 1) and eliminating dry weather overflow 036 (Priority Item 12). These costs not include in previous totals (Refer to page 32). All costs listed are grant eligible.

+ included in $ 8,0[illegible] ([illegible])

At this time the City intends to finance overflow correction projects from existing revenue produced from monthly sewer rate charges to customers for sanitary sewer service. Presently, the monthly charge is $3.50 per residential connection and $2.50 per unit for motels, apartments, and trailer courts. Commercial and industrial charges vary depending on the type of service received.

If 15 percent (state) and 75 percent (federal) grant monies can be made available as needed beginning in 1978, the City proposes to complete all overflow correction work by 1985. Including capital costs, money will have to be made available at the rate of about 12 to 13 million dollars per year through 1985.

If grant monies are not received to assist in financing the project, the City will attempt to abide by the terms of the modified discharge permit which is to be issued to the City in the near future. However, the City cannot guarantee that it will be able to meet any schedule imposed on it if only City funds are available for construction.

This report has outlined a program for correcting combined sewer overflows to the Spokane River. Implementation of the projects proposed in this report will enhance the water quality of the river and will greatly benefit downstream users. Downstream users include property owners along the river, other local citizens, and visitors from other parts of the state nation, or Canada. In order to protect these downstream users,

the City is anxious to get this overflow correction work completed and feels that the effort should be a combined federal, state and local program. It is in this context that the City of Spokane requests financial assistance through the Public Law 92-500 grant program.

RESOLUTION

WHEREAS, the City Council has approved and adopted the final sewer facilities planning report and desires to implement the recommendations contained therein,

BE IT RESOLVED that the program will be implemented when federal and state grant funds are available in amounts satisfactory to complete this work as determined by the City Council.

Adopted by the City Council June 27, 1977.

Marilyn J. Montgomery
Acting City Clerk

Approved as to Form:

Linda M. Youngs
Assistant Corporation Counsel

1:30 TUESDAY, - Our CONF

Claude Sappington
1:30

Larry Neel